REPORT NUMBER 167

**APRIL 1966** 

### ROUND VIBRATION TEST RESULTS

AD 635489

LIFT FAN FLIGHT RESEARCH AIRCRAFT PROGRAM

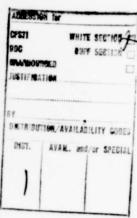
CONTRACT NUMBER DA44-177-TC-715

GENERAL & ELECTRIC

Yound mecen,

REPORT NUMBER 167

GROUND VIBRATION TEST RESULTS

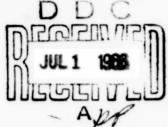


XV-5A Lift Fan Flight Research Aircraft Contract No. DA44-177-TC-715

April, 1966

ADVANCED TECHNOLOGY AND DEMONSTRATOR PROGRAMS DEPARTMENT
GENERAL ELECTRIC COMPANY
CINCINNATI, OHIO 45215

FC#34587



### CONTENTS

SECTION			PAGE
1.0	SUMI	MARY	1
2.0	INTR	ODUCTION	3
3.0	AIRP	LANE RESONANCE TEST	5
	3.1	Test Configuration	5
	3.2	Test Equipment and Instrumentation	5
	3.3	General Test Procedure	6
	3.4	Results and Conclusions	6
4.0	COM	PONENT RESONANCE TEST	9
	4.1	Test Configurations	9
	4.2	Test Equipment and Instrumentation	10
	4.3	Test Procedure	10
	4.4	Results and Conclusions	11
5.0	COM	PONENT STATIC TEST	13
	5.1	Test Configuration	13
	5.2	Test Equipment and Instrumentation	13
	5.3	Test Procedure	13
	5.4	Results and Conclusions	14
6.0	APPE	ENDIX	19
	ADDE	ENDUM A	97

### LIST OF FIGURES

FIGURE		PAGE
1	General Arrangement - XV-5A	49
2	Airplane in Test Position Undergoing Final Test	
	Preparation	51
3	Details of Airplane Suspension System	52
4	Shaker Locations	53
5	Symmetric Pickup Locations	54
6	Antisymmetric Pickup Locations	55
7	Control Surface Pickup Locations - Aileron and	
	Aileron Tab	56
8	Control Surface Pickup Locations - Elevator	57
9	Control Surface Relays Locations - Rudder and	
	Rudder Tab	58
	Airplane Symmetric Mode Shapes	
10	Mode 1 - $f = 11.2 \text{ cps}$	59
11	Mode 2 - $f = 14.1 \text{ cps}$	60
12	Mode $3 - f = 21.4 \text{ cps}$	61
13	Mode $4 - f = 29.4 \text{ cps}$	62
14	Mode $5 - f = 31.3 \text{ cps}$	63
15	Mode $6 - f = 36.3 \text{ cps}$	64
16	Mode $7 - f = 44.7 \text{ cps}$	65
17	Mode $8 - f = 55.9 \text{ cps}$	66
18	Mode $9 - f = 67.8 \text{ cps}$	67
19	Mode $10 - f = 90.3 \text{ cps}$	68
	Airplane Antisymmetric Mode Shapes	
20	Mode 1 - f = 8.8 cps	69
21	Mode $2 - f = 11.9 \text{ cps}$	70
22	Mode $3 - f = 14.5 \text{ cps}$	71
23	Mode $4 - 1 = 18.5 \text{ cps}$	72
24	Mode $5 - f = 23.0 \text{ cps}$	73
25	Mode $6 - f = 25.3 \text{ cps}$	74
26	Mode $7 - f = 34.8 \text{ cps}$	75
27	Mode $8 - f = 36.8 \text{ cps}$	76
28	Mode 9 - $f = 44.6 \text{ cps}$	77
29	Mode $10 - f = 50.6 \text{ cps}$	78
30	Mode $11 - f = 72.9 \text{ cps}$	79

### LIST OF FIGURES (Continued)

FIGURE		PAGE
	Miscellaneous Component Pickup Locations	
31	Flap	80
32	Wing Fan Door	81
33	Nose Fan Door	80
34	Thrust Spoiler	83
<b>35</b> ·	Horizontal Stabilizer Pitch Spring - Load and	
	Instrumentation Schematic	84
36	Horizontal Stabilizer Roll Spring - Load and	
	Instrumentation Schematic	85
37	Horizontal Stabilizer Yaw Spring - Load and	
	Instrumentation Schematic	86
38	Test Setup - Horizontal Stabilizer Pitch Restraint	87
39	Horizontal Stabilizer - Pitch Free Play and	
	Rotational Restraint	88
40	Horizontal Stabilizer - Roll Free Play and	
	Rotational Restraint	89
41	Horizontal Stabilizer - Yaw Free Play and	
	Rotational Restraint	90
	Airplane Symmetric Mode Shapes	
42	Mode 5A - f = 33.2 cps	91
43	Mode 8A - f = 63.6 cps	92
44	Mode 10A - f = 98.3 cps	93
	Airplane Antisymmetric Mode Shapes	
45	Mode 11A - $f = 80.3 \text{ cps}$	94
46	Mode $12A - f = 89.8 \text{ cns}$	95

### LIST OF TABLES

TABLE		PAGE
1	Test Equipment and Instrumentation	21
2	Shaker and Selected Accelerometer Combinations	22
3	Results of Airplane Resonance Test	24
	Normalized Mode Shapes - Airplane Symmetric Resonance Test	
4	Mode 1 - $f = 11.2 \text{ cps}$	25
5	Mode $2 - f = 14.1 \text{ cps}$	26
6	Mode $3 - f = 21.4 \text{ cps}$	27
7	Mode $4 - f = 29.4 \text{ cps}$	28
8	Mode 5 - $f = 31.3 \text{ cps}$	29
9	Mode $6 - f = 36.3 \text{ cps}$	30
10	Mode 7 - $f = 44.7 \text{ cps}$	31
11	Mode $8 - f = 55.9 \text{ cps}$	32
12	Mode 9 - $f = 67.8 \text{ cps}$	33
13	Mode 10 - f - 90.3 cps	34
	Normalized Mode Shapes - Airplane Antisymmetric Resonance Test	
14	Mode 1 - f = 8.8 cps	35
15	Mode $2 - f = 11.9 \text{ cps}$	36
16	Mode $3 - f = 14.5 \text{ cps}$	37
17	Mode 4 - f = 18.5 cps	38
18	Mode $5 - f = 23.0 \text{ cps}$	39
19	Mode $6 - f = 25.3 \text{ cps}$	40
20	Mode 7 - $f = 34.8 \text{ cps}$	41
21	Mode $8 - f = 36.8 \text{ cps}$	42
22	Mode $9 - f = 44.6 \text{ cps}$	43
23	Mode $10 - f = 50.6 \text{ cps}$	44
24	Mode $11 - f = 72.9 \text{ eps}$	45
25	Primary Control Surface Resonances	46
26	Miscellaneous Component Resonances	47

### LIST OF TABLES (Continued)

TABLE		PAGE
	Normalized Mode Shapes - Airplane Symmetric Resonance Test	
27	Mode 5A - f = 33.2 cps	100
28	Mode $8A - f = 63.6 \text{ cps}$	101
29	Mode $10A - f = 98.3 \text{ cps}$	102
	Normalized Mode Shapes - Airplane Antisymmetric Resonance Test	
30	Mode $11A - f = 80.3 \text{ cps}$	103
31	Mode $12A - f = 89.8 \text{ cps}$	104

### 1.0 SUMMARY

The U.S. Army XV-5A Lift Fan Research Aircraft was subjected to ground tests in the summer and fall of 1963 for evaluation of aircraft characteristics complementary to the flutter and vibration analyses conducted on the XV-5A aircraft. In general, the outline as presented in Reference 1 "Ground Resonance Test Plan, U.S. Army XV-5A Lift Fan Research Aircraft" was followed with several items omitted due to time restrictions.

The basic item, that of the airplane ground vibration test, was completed in late 1963 and these results are summarized below. The configuration of the XV-5A aircraft tested represented the aircraft in its conventional flight mode with a gross weight of approximately 9,700 pounds (c. g. at F.S. 243.5). Both symmetric and antisymmetric modes of the aircraft were determined. Although the modes have been classified as airplane normal modes, each mode exhibits a predominant motion of one or more aircraft components i.e. wing, fuselage, horizontal and vertical stabilizers and control surfaces.

### SYMMETRIC AIRPLANE MODES

MODE NO.	FREQUENCY (cps)	DAMPING (g)	PREDOMINANT MODAL CHARACTERISTIC
1	11.2	0.040	Wing Bending
2	14.1	0.044	1st Fuselage Bending
3	21.4	0.106	2nd Fuselage Bending
4	29.4	0.124	Wing and Fan Mode
5	31.3	0.031	Horizontal Stabilizer Bending
6	36.3	0.037	Aileron Rotation
7	44.7	0.068	Wing Torsion
8	55.9	0.033	Horizontal Stab. Pitch and Torsion
9	67.8	0.031	Higher Wing Mode
10	90.3	0.031	Elevator Bending

### ANTISYMMETRIC AIRPLANE MODES

MODE	FREQUENCY	DAMPING (g)	PREDOMINANT			
NO.	(cps)		MODAL CHARACTERISTIC			
1	8.8	0.030	Vertical Stabilizer Bending			
2	11.9	0.045	Horizontal Stabilizer Yaw-			
			Vertical Stabilizer Torsion			

### ANTISYMMETRIC AIRPLANE MODES (Continued)

MODE	FREQUENCY	DAMPING (g)	PREDOMINANT
NO.	(cps)		MODAL CHARACTERISTIC
3	14.5	0.023	Horizontal Stabilizer Roll - 1st
			Fuselage Bending
4	18.5	0.046	Wing Bending
5	23.0	0.019	2nd Fuselage Bending
6	25.3	0.046	Fuselage Torsion
7	34.8	0.040	Fuselage Torsion (Forebody)
8	36.8	0.058	Aileron Rotation
9	44.6	0.063	Wing Torsion
10	50.6	0.033	Rudder Bending -
			Fuselage Torsion
11	72.9	0.025	Horizontal Stabilizer Torsion

### 2.0 INTRODUCT

This report contains the results of the static and dynamic characteristics of the line. Army XV-5A Lift Fan Research Aircraft as pertaining to the flutter and vibration effort on the XV-5A aircraft. The general arrangement of the aircraft tested is shown in Figure 1. The XV-5A is a V/STOL aircraft designed for research flight testing of the General Electric X353-5 Lift Fan Propulsion System.

The report is divided into three basic parts plus an addendum; the basic parts following in general the test plan as outlined in Reference 1, (i.e., Airplane Resonances, Component Resonances and Component Static tests) while the addendum presents the results, in terms of airplane resonances (normal modes) of structural modifications to the empennage required for flutter prevention. The modes presented in the addendum are representative of the current aircraft and thereby void their equivalents presented in the main body of the report. All the other modes presented were not affected by the structural change and therefore are representative of the current aircraft.

The aircraft considered for the airplane resonant test phase was Aircraft No. 2, S/N 506 in its design gross weight condition of approximately 9,700 pounds (partial fuel). The dynamic system was in essence a free-free aircraft with control surfaces free, but with cockpit controls locked in neutral (aileron flight tabs and rudder trim tab were locked to their respective parent surface).

Components considered for the second phase of the testing were all of the control surfaces (conventional flight mode), wing fan doors, pitch fan doors, wing flaps and thrust spoilers. These latter items were tested as installed on the aircraft (No. 1 aircraft, S/N 505) whereas the testing of the horizontal stabilizer was limited to a jig-mounted stabilizer with a simulated pivotal joint.

Static testing, i.e., free play and rotational stiffness tests, were confined to the horizontal stabilizer mounted in the above mentioned jig.

Evaluation of structural modifications to the empennage (presented in the addendum) was conducted on Aircraft No. 1, S/N 505 for the same aircraft configuration as for the basic airplane resonant test, with the exception of the suspension system for which in the latter tests were the actual landing gear with partially deflected tires and locked nose wheel struts.

### 3.0 AIRPLANE RESONANCE TEST

The initial ground vibration test of the XV-5A aircraft was conducted at the Ryan Aeronautical Company's plant, San Diego, California during the period of 30 September, 1963 to 27 October, 1963.

### 3.1 TEST CONFIGURATION

The aircraft configuration consisted of a complete aircraft (No. 2, S/N 62-4506), fueled for a gross weight condition of 9,700 pounds with a c.g. location of F.S. 243.5. All flight instrumentation was either installed or simulated by dummy weights as was pilot simulation. Electrical power and hydraulic system power were supplied by external means. The aircraft was aligned in a level flight attitude simulating the CTOL mode, with all controls locked in neutral by means of the appropriate cockpit control. The aircraft was in a clean state, i.e. all other auxiliary devices such as flaps, thrust poilers, wing fan louvers, etc. were fully retracted. Wing and pitch lift fans were blocked to their stator blades by means of shock cord for the initial test.

The airplane was suspended to simulate a free-flight condition by means of spring-mounted platforms at the main and nose gear CTOL positions. Figure 2 shows the airplane on its suspension system undergoing final preparation before commencement of testing, whereas Figure 3 presents details of the airplane suspension system.

### 3, 2 TEST EQUIPMENT AND INS. TATION

Excitation of the aircraft was provided by eight electromagnetic shakers mounted at various locations on the aircraft as shown in Figure 4. Various combinations of shakers, up to the maximum of eight, were used for modal surveys as will be discussed later. Resonant frequencies and modal surveys were established from the recorded output of accelerometers located throughout the aircraft, the pickup locations being shown in Figures 5 & 6 for the symmetric and antisymmetric test phase of the airplane resonance test. Control surface motion was detected by means of strain-gaged beams in addition to accelerometer outputs. Figures 7 through 9 present the location of the control surface points at which measurements were taken, while Figures 5 and 6 show the location of the strain-gaged beams. Table 1 lists the test equipment and instrumentation utilized in the test.

### 3.3 GENERAL TEST PROCEDURE

Both symmetric and antisymmetric resonances were investigated in a similar manner and differed only by the sense of application of shaker forces. The resonant frequencies of the aircraft were established from the recorded output of certain fixed accelerometers as indicated in Figures 5 and 6. These resonant frequencies were selected on the basis of response studies of various shaker combinations under different force inputs. Frequency sweeps for each main component of the aircraft (i.e. wing, fuselage, horizontal and vertical stabilizers) were made under different loading conditions. The response of the aircraft from one of the fixed accelerometers at one of the drive points plus selected accelerometer outputs from the fuselage and horizontal stabilizer in the case of a symmetric sweep and wing excitation and from the horizontal and vertical stabilizers in the case of antisymmetric sweeps and wing excitation, were utilized in establishing the resonant conditions. Table 2 lists the shaker combinations and selected accelerometer outputs displayed on the response plot (X-Y recorders). Establishment of the airplane resonant frequencies was through a study of the abovementioned response plots, deliberate tuning to the particular mode with the best shaker combination for that component, as shown by the response, study of the decay characteristics of the structure upon excitation cutoff and visual monitoring of the mode. Having established the resonances, tuning to a particular resonance for modal surveys attempted to follow the procedure as discussed in Reference 2. Although not followed completely, the technique of observing forcevelocity phasing (through caliberated strain-gaged links between aircraft and shaker coil) as discussed in Reference 2, allowed utilization of available exciters. The mode shapes for the particular resonant condition were established by utilizing a battery of roving pickups (accelerometers) with measurements made at the pickup locations as shown in Figures 5 through 9. In addition to measurements taken at these points, measurements of suspension system platforms in the coordinate directions were also made. Measurements were recorded in terms of voltages with phasing, with reference to a master pickup determined from oscilloscopes. In addition to these readings, oscillograph recordings were made for each measurement for damping and frequency determination, in addition to the post-vibration-test scanning of doubtful areas.

### 3.4 RESULTS AND CONCLUSIONS

Initial testing of the airplane on its suspension system yielded the following airplane rigid body modes:

Vertical Translation 2. 2 cps Side Translation 1.9 cps

Fore and Aft Translation	$0.7 \mathrm{~cps}$
Pitch	1.7 cps
Roll	$2.2 \mathrm{~cps}$
Yaw	0.7 cps

Excitation for the above modes was by shaker or hand - forcing with response monitored by accelerometers (Statham) located at several points on the aircraft.

Following establishment of the resonant frequencies for both the symmetric and antisymmetric case, complete modal surveys of the aircraft were made utilizing a battery of roving accelerometers (Endevco) as mentioned previously. Examination of the resulting mode shapes, when plotted against major structural elements, (for example, deflection along the wing rear spar versus butt-line) indicated inconsistencies among data points in a number of cases. Assuming errors in voltmeter readings, the oscillograph recordings were reduced to reflect the deflection relative to the voltage reading at a reference point and plotted. To determine the final mode shape, the individual plots, if necessary, were smoothed by the method of least squares utilizing best fit data (voltmeter or oscillograph readings). The smoothed plot was then further scrutinized for continuity at major structural intersections and refitted or faired, if necessary, to obtain continuity. A major reason for inconsistencies among mode shapes was the inability of maintaining calibration among the battery of five accelerometers used for modal surveys. Preliminary node line sketches, taken during mode set-up, aided in establishing the deflection shapes of each mode.

A summary of the resonant frequencies and the predominant nature of the mode is given in Table 3. The normalized displacements of the symmetric modes are presented in Tables 4 through 13 and are shown in pictorial form in figures 10 through 19. The fuselage readings for the antisymmetric case were reduced to reflect the linear and angular displacements about W. L. 100. Similar results for the antisymmetric modes are shown in Tables 14 through 24 and in Figures 20 through 30. Structural damping coefficients (g) for each mode are also presented in Table 3, with these values determined from the modal decay oscillograph recording of the dominant pickup location for the predominant component of the airplane.

The predominant modes of interest in an analysis of the empennage, the critical aspect of the XV-5A aircraft with respect to a flutter analysis, would be Modes 1, 2, 3, 4, 5, 8 and 10, symmetric. Although several of these modes have been classified as predominant wing or fuselage modes, the response of the empennage (horizontal tail) in these modes is significant enough to be included in an analysis. Modes 5 and 8 are the

basic elastic modes of the horizontal stabilizer, with Mode 8 being coupled pitch-torsion. There was no evidence of a pure pitch mode existing, a fact established previously, (see Section 4.0).

For the antisymmetric case, the modes of interest to an empennage analysis would be Modes 1, 2, 3, 5, 6, 10 and 11. The horizontal tail rigid body modes of yaw and roll are pronounced, as evidenced in the pictorial views of Figures 21 and 22. Horizontal tail pitch no longer appears, due to the symmetric nature of this mode. Vertical stabilizer torsion is evident in Mode 2, but is highly coupled with the fuselage and the effects of the horizontal tail yaw. The node line is evidenced by Figure 21, (although not drawn), runs up the vertical stabilizer and is swept back through the trailing edge of the stabilizer, due to the elastic effects of the fuselage.

### 4.0 COMPONENT RESONANCE TEST

With the establishment of the basic airplane yibration modes, emphasis was then placed upon determining the vibration characteristics of miscellaneous components of the aircraft i.e. lateral, longitudinal and directional control systems (CTOL mode), flaps, wing fan doors, pitch fan doors and thrust spoiler. Separate resonance testing of the jigmounted horizontal stabilizer was performed to determine rigid body modes about the pivotal joint. The former test period extended from 18 November, 1963 to 25 November, 1963, whereas the latter preceded the ground vibration testing of the complete aircraft and covered the period of from 7 September, 1963 to 9 September, 1963.

### 4.1 TEST CONFIGURATIONS

The test configurations, so employed in the component resonance test, may be conveniently grouped into three categories, mainly primary control systems, horizontal stabilizer and finally miscellaneous components.

### 4.1.1 Primary Control Systems

In order to provide meaningful data for eventual incorporation into future analytical flutter analyses, the test configuration of the aileron, elevator and rudder systems were so arranged to provide both a stick-free and stick-fixed system with the locking out by external means of any control surf surface or tab degree of freedom as the case warranted. Since the primary objects of these tests were systems, and not airframe, the airplane was placed upon its jacks to provide additional restraints. The aircraft tested for this phase was the No. 1 aircraft, S/N 505, which was in a partial state of completion at the time of testing. Electrical power and hydraulic system power were supplied by external means.

### 4.1.2 Horizontal Stabilizer

Since the sole objective of the horizontal stabilizer test was to determine its rigid body viluatory characteristics, the test configuration used was the complete stabilizer (with a simulated pivotal joint) from the No. 2 (S/N 62-506) aircraft mounted on a rigid test stand. A flight pitch actuator was used and the pivot and actuator attach fittings on the test stand were manufactured with identical tolerances with the flight hardware. The pitch

actuator, being a mechanical jackscrew, driven by hydraulic motors, was preset in the desired postion mechanically and thereby no external means of power was required for these tests.

### 4.1.3 Miscellaneous Components

Test configurations of the flaps, wing fan doors, pitch fan doors and thrust spoiler were the actual items as installed on the aircraft, with the same aircraft used as during the primary control systems test.

### 4.2 TEST EQUIPMENT AND INSTRUMENTATION

Excitation of the aircraft components was provided by one or two, (as the case warranted) electromagnetic shakers mounted either in the cockpit or at an optimum position on the appropriate control or auxiliary device. Excitation of the horizontal stabilizer was by means of two shakers located at various points on the surface to provide the required moment about the pivotal joint, as shown in Figure 4. These locations were designated by the term, "secondary". Resonant frequencies and modal surveys, if any, were established from the recorded output (voltages) of accelerometers (Endevco) which were located at strategic points on the components. Figures 7 through 9 present the locations of the control surface points which were used for the tests, while Figures 31 through 34 present the locations of pick-up points on the flap, wing fan door, pitch fan door and thrust spoiler. Horizontal stabilizer locations are shown in Figures 5 and 6 with the appropriate points used as per sense of excitation.

### 4.3 TEST PROCEDURE

In general, the test procedure used in determining the component resonances was similar to that performed on the basic airplane vibration test. Initial frequency sweeps were made of the particular system or component under investigation. The resonances were noted from the resulting response plot and visual observation, manually tuning to these resonances for sharper definition and finally, modal surveys made, if needed by the roving pickup technique with a pair of accelerometers (Endevco), one being used as a reference and one as the roving transducer. Upon completion of the survey, oscillograph records were taken for frequency and damping determination.

### 4.4 RESULTS AND CONCLUSIONS

Since the rigid body modes were the primary objectives of this phase of testing, no pictorial views are presented.

The primary control systems' resonance test yielded partial results, due to difficulties encountered in modal coupling with the airframe proper. Additional restraints, other than aircraft jacks, proved to be impractical. Therefore, only those vibration modes which were felt to be indicative of the control systems are recorded herein. Table 25 presents the results of this phase of the component resonance testing. As can be seen from the results, the aileron system and elevator system tests proved to be more fruitful than the rudder system tests. This ties in with the manner in which the aircraft is supported by jacks; the two on the wings plus the fuselage jack at location F-8 provided the additional vertical restraint needed for excitation in the vertical sense, whereas excitation in the horizontal plane as in the case of rudder system, brought into play the lateral flexibility of the fuselage and vertical stabilizer. Isolation of the aileron flight tab uncoupled rotational mode proved to be an impossibility, since the only restraint provided for the aileron itself was the hydraulic actuator which provided only a point fixity.

Determination of the miscellaneous components was relatively simple and the results of these tests are presented in Table 26.

Establishment of the rigid body modes of the horizontal stabilizer yielded only one, or at the best, two valid frequencies, that of yaw and roll. The yaw mode was 12.9 cycles per second and could be considered representative of the actual case, whereas the roll mode was determined to be 16.85 cycles per second. Investigation of jig motion revealed that a small percentage of coupling was apparent between jig and stabilizer. Comparison of these modes with those presented in Section 3.0 shows 11.9 cycles per second, yaw versus 12.9 cycles per second and 14.5 cycles per second, roll versus 16.85 cycles per second. Comparison is good when considering the nature of the test, i.e. jig-mounted horizontal versus actual aircraft shake, wherein modal coupling is more pronounced, due to vertical stabilizer and fuselage effects. In any event, these modes were considered for inertia correlation, as will be discussed in Section 5.0. Isolation of the pitch mode, particular to the effects of simulation, was impossible, due to coupling with the elastic modes of the horizontal stabilizer. The following modes were noted for interpretive purposes:

Bending - Pitch	24.7 cps
Pitch - Bending - Torsion	42.1 cps
Pitch - Torsion - Bending	50.8 cps

Examination of these modes with those determined from the airplane resonance test, and the frequency determined from the static tests (Section 5.0) verified the inability of determining the true uncoupled pitch mode.

### 5.0 COMPONENT STATIC TEST

Static testing of components of the XV-5A aircraft for flutter and vibiation correlation was restricted entirely to determination of the effective spring rates (about coordinate axes) of the three degrees of freedom associated with the rigid body motion of the horizontal stabilizer. This test was conducted jointly with the resonance testing of the horizontal stabilizer, as discussed in Section 4.0, and covered the period of from 7 September, 1963 to 9 September, 1963 and also 17 March 1964.

### 5.1 TEST CONFIGURATION

The test configuration, employed for this phase was the complete horizontal tail from the No. 2 (S/N 506) aircraft for the yaw and roll investigations, whereas the No. 1 (S/N 505) horizontal stabilizer (less elevators) was used for the pitch tests. Mounting was separate from the aircraft and employed the same fixture as described in Section 4.0 with the actual actuator installed.

### 5.2 TEST EQUIPMENT AND INSTRUMENTATION

In each phase of the testing of the horizontal stabilizer, loads were applied to the horizontal stabilizer through a loading jig that enclosed the rib at BL 70.16 on both ends of the stabilizer. An additional pair of loading jigs at BL 16.56 was used in the pitch test. A pulley system was used to obtain the proper load direction, and 20 or 25-pound shot bags placed upon load pans provided the applied torque in the appropriate direction.

Dial gages located at selected points on the surface were used to measure deflection. In addition, small mirrors, reflecting a cross-hair image from a light source onto a calibrated screen, were used to measure change of slope. Schematics of the pitch, roll and yaw loading and instrumentation set-ups are shown in Figures 35 through 37, whereas Figure 38 depicts a photo of the test set-up for the pitch phase.

### 5.3 TEST PROCEDURE

The test procedure to determine effective restraints was simply orientation of the loading jig and dial gages and/or mirrors for proper axis definition, with the load being applied in incremental parts with deflection and/or

slope information being simultaneously measured. A complete load cycle gave data on both sides of the free-play regime, enabling the spring rates and free-play to be determined.

### 5.4 RESULTS AND CONCLUSIONS

Interpretation of effective spring rates as obtained from these series of tests was somewhat difficult, since it was not known to what extent local back-up structure in the vertical stabilizer had in the apparent idealization of these effective springs. It was assumed that for the roll and yaw springs, the pivotal joint (which was of the same material and incorporated actual pivot bolts) would yield approximate results valid for analysis purposes.

The pitch spring was apparently misleading, since the effective pitch spring is, in essence, composed of the actuator, pivot fittings, bearings, horizontal stabilizer local back-up structure and also local back-up structure of the vertical stabilizer which was not simulated. Therefore, determination of this spring rate had to be approached with caution.

### 5.4.1 Pitch Spring

The deflection and load data taken at the locations shown in Figure 35 were reduced and plotted as angular rotation versus applied pitching moment as shown in Figure 39. These data were reduced by treating the root ribs as an overhanging box beam simply supported at the actuator - front spar intersection and horizontal stabilizer pivot. Deflection data for each increment of load taken at dial gages 1 and 2 were averaged, and combined with the average data from gages 3 and 4 to describe the rotation of a plane representative of the elastically - undeformed horizontal stabilizer. Then, computing the angular rotation of the support jig for each increment of load from the deflection data of gages 7 through 11, and subtracting, the net angular rotation in pitch versus applied load was obtained.

Figure 39 shows that the spring rate is non-linear and increases with applied load. This result is reasonable, since the system has a number of bearing contacts where total bearing area increases with load.

The minimum pitch spring rate and the minimum average pitch spring rate determined from the slope of the curves between the first two data points on both sides of the free-play region are:

Minimum Pitch Spring Rate =  $9.5 \times 10^6$  in-lb./rad. Minimum Average Pitch Spring Rate =  $11.4 \times 10^6$  in-lb./rad. The experimental pitch spring rate used in conjunction with calculated effects of vertical stabilizer was  $10.33 \times 10^6$  in-lb./rad., with a resulting effective pitch spring rate of  $6.09 \times 10^6$  in-lb./rad.

Approximately 2,000 inch - pounds of moment (leading edge down) was required to balance the stabilizer in the loading jig. The free play was determined from Figure 39 at this load level to be as follows:

Pitch Free Play = 0.0011 radians

Inability to shake out a rigid body pitch mode resulted in using experimental inertia properties in an attempt to arrive at a value for use in flutter analysis correlation. Swinging of the horizontal tail gave the following results as compared to the calculated value:

$$I_{\text{Pivot}} = 43,085 \text{ lb.} - \text{in}^2$$

Experimental

$$I_{Pivot} = 34,440 \text{ lb.} - \text{in.}^2$$

Calculated

Thus, it can be seen that the calculated value had been underestimated by a factor of 1.25.

Using the minimum projected spring rate of  $6.09 \times 10^6$  in-lb./rad. in conjunction with the experimental inertia value, the estimated value of the uncoupled pitch frequency was determined to be:

f = 37.2 cycles/second

### 5.4.2 Roll Spring

The mirror and load data taken at the locations shown in Figure 36 were reduced and plotted as angular rotation versus applied rolling moment as shown in Figure 40. The angular values in the plot were determined by averaging the net roll angle experienced at mirror locations 1 and 2 obtained by subtracting from each the angular rotation at mirror location 3. An average of the slope of the two straight line least square fits of the data for each load direction was considered to be the roll spring rate, and the horizontal distance between their zero load intercepts was considered the the roll free-play. These values are as follows:

Average Roll Rotational Spring Ratio =  $11.3 \times 10^6$  in. - lb./rad.

Roll Rotational Free-Play = 0.00032 radians

The difficulty inherent in the geometry of the horizontal stabilizer pivot fitting support, wherein the applied rolling moment must be reacted by a couple with only a 6.06 inch moment – arm, created an inpractical test situation. The roll spring is composed of the elasticity present in the pivot fitting, bearings and local back-up structure. Any method of loading this system must produce elastic deformation of the stabilizer surface proper. Therefore, the measurements of slope during the test included any beam deformation of the horizontal stabilizer. In deriving the roll spring rate from the test data, it was assumed that the change in slope of the elastic curve due to deformation of the stabilizer as a beam in the support area was small, compared to the change of slope due to rigid body roll.

Comparision of roll inertias (about BL O and WL 201.75) both calculated from weights information and also from static and frequency measurements yielded the following:

$$I_{Roll} = 389,544 \text{ lb.} - \text{in.}^2$$
 Experimental

$$I_{Roll} = 166,541 \text{ lb.} - \text{in.}^2$$
 Calculated

From the above, it can be seen that the calculated value had been underestimated by a factor of 2.34. However, closer examination of the spring rate determination indicated movement of the support jig which also may have been involved in the vibration mode. Consequently, the factor of 2.34 may be somewhat larger than it should be, if jig motion was non-existent during resonance. The test essentially indicates an uncoupled roll frequency of the order of 16 cps and also that calculated inertia values are low. Examination of deflection data taken during the vibration test indicated some small deflection, both in the lateral and vertical sense of the pivot assembly and mounting jig, thereby warranting the above conclusion.

### 5.4.3 Yaw Spring

The mirror and load data taken at the locations shown in Figure 37 were reduced and plotted as angular rotation versus yawing moment as shown in Figure 41. The angular values in the plot were obtained by subtracting the rotation at mirror 2 from the rotation at mirror 1 for each loading increment. An average slope of the straight line least square fits of the data for each loading direction established the spring rate, and the horizontal distance between their zero load intercepts represented the free-play. These values are as follows:

Average Yaw Rotational Spring Rate = 3.11 x 10<sup>6</sup> in.-lb 'rad.

Yaw Rotational Free-Play = 0.00033 radians

Comparison of yaw inertias (about vertical axis through pivot), calculated from weights information and also from the static and frequency measurements yielded the following:

$$I_{Yaw} = 182,919 \text{ lb.} - \text{in.}^2$$
 Experimental   
 $I_{Yaw} = 194,434 \text{ lb.} - \text{in.}^2$  Calculated

From the above, it can be seen that the calculated value had been overestimated by a factor of 0.94. Examination of the deflection measurements taken during the shake test indicates negligible movement of the base (jig) and therefore correlation between the inertias as shown above is considered excellent.

### 6.0 APPENDIX

### REFERENCES

- Ground Resonance Test Plan, Report Number 128, September, 1963.
- 2. Lewis, R.C. and Wrisley, D.L.; A System for the Excitation of Pure Natural Modes of Complex Structures, Journal of the Aeronautical Sciences, Volume 19, 1950.
- 3. <u>Preliminary Flutter Analysis, Volume II Empennage,</u> Report Number 163, November, 1965.

### TABLE 1

### TEST EQUIPMENT AND INSTRUMENTATION

### **Exciter System**

- 1. Calidyne Model 3810 exciter system utilizing eight (8) Calidyne Model D-88 excitors rated at 100 pound vector force.
- 2. MB Model PT 112537 exciter system utilizing two (2) MB Model C-1-H excitors rated at 50 pound vector force.
- 3. Hewlett-Packard sweep oscillator Model 202A.
- 4. Hewlett-Packard frequency counter Model 522.
- 5. Ryan manufactured strain gaged force rings in conjunction with a CEC Model 1-113 carrier amplifier.
- 6. Bruel and Kjaer vacuum tube Model 2409 voltmeters.
- 7. Dumont dual beam Model 304 oscilloscopes.

### Instrumentation

- 1. Endevco Model 2213 crystal-type accelerometers used in conjunction with Endevco Model 2607 amplifiers.
- 2. Statham Model F-10-350 strain-gage accelerometers used in conjunction with Consolidated Electrodynamics System "D" amplifier/power supply.
- 3. Minneapolis-Honeywell 12-channel Model 906 oscillograph.
- 4. Minneapolis-Honeywell 24-channel Model 1508 oscillograph.
- 5. X-Y plotters.
- 6. Dumont dual beam Model 304 oscilloscopes.
- 7. Bruel and Kjaer vacuum tube Model 2409 voltmeter.
- 8. Khron-Hite variable band-pass Model 330M filters.

TABLE 2

SHAKER AND SELECTED ACCELEROMETER COMBINATIONS
Airplane Resonance Sweeps

		Sha	Shaker Configuration					Plo	Plotter Configuration			
Aircraft	Sweep	s	Shaker Locations		1	Plotter	1	2	2	3		
Component	Configuration		Pł	nase		Symmetry	Component	Wing	Fuselage	V. T.	н. т.	
Wing	A	P-1 +			P-2	$\mathbf{s}$	Pickup Location	LW-1	F-2	-	1.11-1	
	В	,	P-3	P-4	<b>,</b>	s	Location	LW-15	F-2	_	LH-1	
	С	P-1	P-3	P-4	P-2	$\mathbf{s}$		1.W-1	F-2	_	1,11-1	
	D	P-1	P-3	P-4	P-2	$\mathbf{s}$		I.W+1	F-2	_	LH-1	
	J		P-3A	P-4A		$\mathbf{s}$		LW-13	F-2	_	1.11-1	
	к	P-1	P-3A	P-4A	P-2	$\mathbf{s}$		LW-13	F-2	-	1.11-1	
	L	P-1	P-3A —	P-4A	P-2	s		LW-13	F-2		LH-1	
	х	P-3	P-3A	P+4 +	P-4A	S		LW-15	F'-2	_	LH-1	
	М	P-1			P-2	A/S		LW-1	F-12	_	LH-1	
	Q	P-1	P-3A —	P-4A	P-2 	A/S		LW-1	-	V-10	LH-1	
	R	P-1 +	P-3A +	P-4A 	P-2 -	A/S		LW-1	_	V-10	LH-1	
	s		P-3A +	P 4A		A/S		LW~13		V-10	1.H-1	
	Т		P-3 +	P-4 		A/S		LW-15	-	V-10	LH-1	
	U	P-1	P-3 -	P=4	P-2 —	A/S		LW-1		V-10	L.H - 1	
	V		P-3 +	P-4 -	P-2 -	A/S		LW-1			LH-1	
	с-с	•	P-3A -	P-4 —	P-4A	A/S		LW-15	_		i.H-1	
Fuselage	E	P-5				S		1.W-1	F-2		I.H-1	
	F				P-5A +	s		LW-1	F-8		1.H-1	
	Н	P-5			P-5A	$\mathbf{s}$		L\V-1	F-2		LH-1	
	ı	P-5			P-5A	s		LW-1	F-2		LH-1	
Horizontal Tail	G 	P-6 +			P-7	$\mathbf{s}$		1.W-1	F-2		L.H 1	
	w	P-6A +			P-7A	s		1.W-1	F-2	_	LH-2	

### TABLE 2 (Continued)

### SHAKER AND SELECTED ACCELEROMETER COMBINATIONS Airplane Resonance Sweeps

		Shaker Configuration						Plo	on		
Aircraft Component	Sweep Configuration	1		Locati hase	ons	Symmetry	Plotter Component	1 Wing	2 Fuselage	2 V. T.	3 H. T.
Horizontal	P	P-6			P-7	A/S	Pickup	LW-1	_	V-10	LH-1
Vertical Tail	Y	+	P-8		-	A/S	Location	LW-1	_	V-10	LH-1
	z		+	P-9		A/S		LW-1	_	V-11	LH-1
	A-A		P-8	P-9		A/S		LW-1	_	V-11	LH-1
	в-в		+ P-8	P-9	!	A/S		1.W-1		V-11	LH-1
		,	l +	-	I	1		[			

TABLE 3

RESULTS OF AIRPLANE RESONANCE TEST

Symmetric

Mode	Frequency cps	g	Table No.	Figure No.	Predominant Modal Characteristic
1	11.2	0.040	4.0	10.0	Wing Bending
2	14.1	0.044	5.0	11.0	1st Fuselage Bending
3	21.4	0.106	6.0	12.0	2nd Fuselage Bending
4	29.4	0.124	7.0	13.0	Wing and Fan Mode
5	31.3	0.031	8.0	14.0	Horizontal Stabilizer Bending
6	36.3	0.037	9.0	15.0	Aileron Rotation
7	44.7	0.068	10.0	16.0	Wing Torsion
8	55.9	0.033	11.0	17.0	Horizontal Stabilizer Pitch & Torsion
9	67.8	0.031	12.0	18.0	Higher Wing Mode
10	90.3	0.031	13.0	19.0	   Higher Horizontal Stabilizer Mode

Anti-Symmetric

Mode	Frequency cps	g	Table No.	Figure No.	Predominant Modal Characteristic
1	8.8	0.030	14.0	20.0	Vertical Stabilizer Bending
2	11.9	0.045	15.0	21.0	Horizontal Stabilizer Yaw - Vertical Stabilizer Torsion
3	14.5	0.023	16.0	22.0	Horizontal Stabilizer Roll – 1st Fuselage Bending
4	18.5	0.046	17.0	23.0	Wing Bending
5	23.0	0.019	18.0	24.0	2nd Fuselage Bending
6	25.3	0.046	19.0	25.0	Fuselage Torsion
7	34.8	0.040	20.0	26.0	Fuselage Torsion (Forebody)
8	36.8	0.058	21.0	27.0	Aileron Rotation
9	44.6	0.063	22.0	28.0	Wing Torsion
10	50.6	0.033	23.0	29.0	Rudder Bending – Fuselage Torsion
11	72.9	0.025	24.0	30.0	Horizontal Stabilizer Torsion

TABLE 4

SYMMETRIC MODE SHAPE MODE 1 f = 11.2 cps g = 0.040

				t = 11.2 c	f = 11.2  cps  g = 0.040				
<b>'</b>	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defil.		Vert. Defl.
Position	dn +	Position	4 Up	Position	+ Up	Position	4∙ Up	Position	+ Up
LW-1	0.6932	LH-1	$\bar{0}$ .3973	F-1	0.3086	LA-1	0.8559	LE-1	0.5386
LW-2	0.7749	LH-2	$\bar{0}.4715$	F-2	$\tilde{0}$ . 2029	LA-2	1.0000	LE-2	$\bar{0}$ . 6654
LW-3	0.8935	LH-3	$\bar{0}.3973$	F-3	$\tilde{0}$ . 1403	LA-3	0.7390	LE-3	$\bar{0}$ . 5386
LW-4	0.5787	LH-4	0.4715	F-4	$\bar{0}$ . 0909	LA-4	0.8897	LE-4	$\bar{0}$ . 6654
LW-5	0.6656	LH-5	$\overline{0}$ .3973	F-5	$\bar{0}$ .0489	LA-5	0.6329	LE-5	$\bar{0}$ . 5386
TW-6	0.7447	9-HT	$\overline{0}$ .4715	F-6	$\bar{0}$ . 0384	LA-6	0.7871	LE-6	$\bar{0}$ . 6654
LW-7	0.4730	LH-7	0.2890	F-7	$\bar{0}.0677$	LA-7	0.5072	LE-7	$\bar{0}$ . 5386
LW-8	0.5591	LH-8	0.3973	F-8	$\bar{0}$ . 1236	I.A-8	0.5760	LE-8	$\vec{0}$ . 6654
LW-9	0.6076	CH-9	$\overline{0}$ .4715	F-9	$\bar{0}$ . 1966	LA-9	0.4384	LE-9	$\bar{0}$ . 5386
LW-10	0.3762	LH-10	$\overline{0}$ . 2890	F-10	$\bar{0}$ .3663	LA-10	0.5143	LE-10	$\bar{0}$ . 6654
LW-11	0.4555	LH-11	0.4715	Win	Wing Fan	LA-11	0.4008	LE-11	$\bar{0}$ . 5386
LW-12	0.4821	LH-12	0.2890		Vert. Defil.	LA-12	0.4753	LE-12	$\bar{0}.6654$
LW-13	0.2901	LH-13	0:4715	Position	dn +		•		
LW-14	0.3568	LH-19	0.3973	LWF-1	0.1996				
LW-15	0.3707	LH-20	0.3973	LWF-2	0.2205				
LW-16	0.1985		F & A Defl.	LWF-3	0.4125	71			
LW-17	0.2521		+ Aft	LWF-4	0,1160				
LW-18	0.1198	LH-14	0.3042	Pitch	Pitch Fan				
LW-19	0.1483	LH-15	0.3042		Vert. Defl.				
LW-20	0.0572	LH-16	0.3042	Position	+ Nb				
LW-21	0.0702	LH-17	0.3042	NF-1	$\overline{0}.2148$				
LW-22	1	LH-18	0.3042						
LW-23	1	_	_						

TABLE 5

# SYMMETRIC MODE SHAPE MODE 2 f = 14.1 cps g = 0.044

				7 - 11. 1	11: 1 cha 8 - 0.011				
<b>1</b>	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	t Up	Position	dn +	Position	+ Up	Position	+ Up	Position	
LW-1	0.6081	LH-1	0.3405	F-1	0.4412	LA-1	0.7349	LE-1	0.6023
LW-2	0.6772	LH-2	0.5395	F-2	0.1942	LA-2	1.0000	LE-2	0.5581
LW-3	0.6721	LH-3	0.3240	F-3	0.0581	LA-3	0.6442	LE-3	0.5814
LW-4	0.5002	LH-4	0.5019	F-4	$\bar{0}.0502$	LA-4	0.9093	LE-4	0.5465
LW-5	0.5616	LH-5	0.3074	F-5	$\bar{0}$ . 1093	LA-5	0.5530	LE-5	0.5395
LW-6	0.5588	LH-6	0.4698	F-6	$\bar{0}$ . 1442	1.A-6	0.8209	LE-6	0.5232
LW-7	0.3998	LH-7	0.2209	F-7	$\bar{0}$ . 1302	LA-7	0.4277	LE-7	0.4953
LW-8	0.4500	LH-8	0.2909	F-8	0.0486	I.A-8	0.6512	LE-8	0.5140
LW-9	0.4516	LH-9	0.4437	F-9	0.0565	I.A-9	0.3442	LE-9	0.4465
LW-10	0.3070	LH-10	0.2209	F-10	0.2940	LA-10	0.5651	LE-10	0.4884
LW-11	0.3416	LH-11	0.4237	Win	Wing Fan	LA-11	0.2893	LE-11	0.4326
LW-12	0.3502	LH-12	0.2209		Vert. Defl.	LA-12	0.5186	LE-12	0.4884
LW-13	0.2235	LH-13	0.4072	Position	+ Up		•		
LW-14	0.2393	LH-19	0.2837	LWF-1	0.2442				
LW-15	0.2567	LH-20	0.2837	LWF-2	0.3047				
LW-16	0.1333		F & A Defl.	LWF-3	0.0930				
LW-17	0.1521		+ Aft	LWF-4	$\vec{0}$ . 1581				
LW-18	0.0547	LH-14	0.3209	Pitch	Pitch Fan				
LW-19	0.0581	LH-15	$\bar{0}.3209$		Vert. Defl.				
LW-20	$\bar{0}.0102$	LH-16	$\bar{0}.3209$	Position	<b>4</b> Up				
LW-21	$\bar{0}.0249$	LH-17	$\bar{0}.3209$	NF-1	0.2791				
LW-22	!	LH-18	$\bar{0}.3209$						
LW-23	1				_				

## SYMMETRIC MODE SHAPE MODE 3 f = 21.4 cps g = 0.106

				I = 21.4 (	I = 21.4  cps  g = 0.106				
1	Wing	Horiz	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Ver⁴. Defil.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	+ Up	Position	+ Up	Position	+ Up	Position	+ Up	Position	+ Up
LW-1	0.2829	LH-1	0.4153	F-1	1.0000	LA-1	0.5128	LE-1	$\bar{0}.7140$
LW-2	0.3855	LH-2	$\bar{0}$ . 6638 1	F-2	0.3294	LA-2	0.8201	LE-2	0.6388
LW-3	0.4825	LH-3	$\bar{0}$ . 2880	F-3	0.0464	LA-3	0.4487	L.E-3	$\bar{0}.6145$
LW-4	0.1392	LH-4	$\overline{0}$ . 4989	F-4	$\bar{0}$ . 1034	LA-4	0.7515	LE-4	$\bar{0}.5504$
LW-5	0.3128	LH-5	$\overline{0}$ . 1939	F-5	$\tilde{0}$ . 1463	I.A-5	0.3957	LE-5	$\bar{0}.4752$
LW-6	0.3985	9-HT	$\bar{0}.3716$	F-6	0.0840	I.A-6	0.6874	LE-6	$\bar{0}.4244$
LW-7	0.0177	LH-7	0.0427	F-7	0.1702	LA-7	0.3205	LE-7	$\bar{0}.3890$
LW-8	0.2502	LH-8	$\overline{0}$ . 1328	F-8	0.2144	I.A-8	0.6123	LE-8	$\bar{0}.3382$
LW-9	0.3247	FH-1	$\bar{0}$ . 2818	F-9	0.2100	LA-9	0.2741	LE-9	$\bar{0}.3095$
LW-10	0.0729	LH-10	0.0502	F-10	0.1105	LA-10	0.5614	LE-10	$\bar{0}$ . 2431
LW-11	0.1976	LH-11	$\overline{0}$ . 2299	Win	Wing Fan	LA-11	0.2431	LE-11	$\bar{0}$ . 2763
LW-12	0.2611	LH-12	0.0601		Vert. Defl.	LA-12	0.5261	LE-12	$\bar{0}$ . 1989
LW-13	$\bar{0}.1282$	LH-13	$\bar{0}$ . 2175	Position	dn +		_		
LW-14	0.1558	LH-19	$\overline{0}$ .0928	LWF-1	0.2011				
LW-15	0.2087	LH-20	0.0752	LWF-2	$\bar{0}.2454$				
LW-16	0.1463		F & A Defl.	LWF-3	0.1039				
LW-17	0.1589		+ Aft	LWF-4	$\bar{0}$ . 1083				
LW-18	0.1463	LH-14	0.3117	Pitc	Pitch Fan				
LW-19	0.1238	LH-15	0.3117		Vert. Defl.				
LW-20	0.1463	LH-16	0.3117	Position	dn +				
LW-21	.1039	LH-17	0.3117	NF-1	0.2277				
LW-22	1	LH-18	0.3117						
LW-23	-    -								

## SYMMETRIC MODE SHAPE MODE 4

				f = 29.4 c	29.4  cps g = 0.124				
	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	+ Up	Position	t Up	Position	+ Np	Position	dn +	Position	4 Up
LW-1	0.3556	LH-1	$\bar{0}.3659$	F-1	$\bar{0}$ . 0331	LA-1	0.5165	LE-1	0.6476
LW-2	0.3632	LH-2	$\overline{0}$ , 4989	F1-2	0.0256	LA-2	1,0000	LE-2	0.6096
LW-3	0.4368	LH-3	0.2440	F-3	0.0137	LA-3	0.4505	LE-3	0.5740
LW-4	0.1691	LH-4	0.3919	편-4	$\bar{0}$ .0141	LA-4	0.9473	1 4	$\frac{1}{0}$ . 5247
LW-5	0.2796	LH-5	0.1231	F~5	$\bar{0}.0436$	LA-5	0.3879	LE-5	0.4379
LW-6	0.5519	9-HT	0.3022	F-6	$\bar{0}.0012$	I.A-6	0.8945	LE-6	0.3834
LW-7	0.0357	LH-7	0.1571	F-7	0.0352	LA-7	0.3066	LE-7	0.3124
LW-8	0.2049	LH-8	$\bar{0}$ . 0330	F4 80	0.0725	LA-8	0.9352	LE-8	$\frac{1}{0}$ , 2745
LW-9	$\frac{0.2762}{}$	LH-9	$\overline{0}$ , 2300	표-9	0.0978	LA-9	0.2582	LE-9	$\frac{1}{0}$ . 1890
LW-10	0.0522	LH-10	0.1989	F-10	0.0912	LA-10	0.9044	LE-10	$\bar{0}$ .1729
LW-11	0.1391	LH-11	0.1754	Win	Wing Fan	LA-11	0.2297	LE-11	$\overline{0}$ . 1428
LW-12	0.2095	LH-12	0.2143		Vert. Defl.	LA-12	0.8846	LE-12	0.1448
LW-13	0.1015	LH-13	0.1319	Position	t Up	-	•		) 1 1
LW-14	0.0834	LH-19	0.0264	LWF-1	0.1945				
LW-15	0.1532	LH-20	0.0571	LWF-2	$\bar{0}$ . 2604				
LW-16	0.1226		F & A Defl.	LWF-3	$\overline{0}$ . 1231				
LW-17	0.0973		+ Aft	LWF-4	$\bar{0}$ . 1132				
LW-18	0.1144			Pitci	Pitch Fan				
LW-19	0.0527	LH-14	0.0833		Vert. Defl.				
LW-20	0.0909	LH-15	0.0833	Position	+ Cp				
LW-21	0.0255	LH-16	0.0833	NF-1	0.0198				
LW-22	ı	LH-17	0.0833						
LW-23	1	LH-18	0.0833						

### TABLE 8

## SYMMETRIC MODE SHAPE MODE 5 f = 31.3 cps g = 0.031

				1 - 01.0	o1. 5 cps g - 0.051				
	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	dn +	Position	+ Up	Position	+ Up	Position	+ Up	Position	4 Up
LW-1	1	LH-1	0.7397	F-1	0.0174	LA-1	l	LE-1	0.8498
LW-2	ı	LH-2	1.0000	F-2	0.0224	LA-2	ı	LE-2	0.8653
LW-3	ı	LH-3	0.4487	F-3	0.0137	LA-3	ı	LE-3	0.7284
LW-4	ı	LH-4	0.6784	F-4	$\bar{0}$ .0037	LA-4	ı	LE-4	0.7375
LW-5	ı	LH-5	0.2168	F-5	$\tilde{0}.0186$	LA-5	ı	LE-5	0.5136
LW-6	l	9-HT	0.4151	F-6	0.0211	I.A-6	ı	LE-6	0.5144
LW-7	1	LH-7	0.0960	F-7	0.0336	LA-7	ı	LE-7	0.3291
LW-8	1	LH-8	0.0438	F-8	0.0361	I.A-8	ı	LE-8	0.3267
LW-9	1	1.H-9	0.2099	F-9	0.0236	LA-9	i	LE-9	0.1112
LW-10	ı	LH-10	0.1550	F-10	$\vec{0}$ .0759	LA-10	ı	LE-10	0.1143
LW-11	I	LH-11	0.0629	Win	Wing Fan	LA-11	ı	LE-11	0.0037
LW-12	ı	LH-12	0.1696		Vert. Defl.	LA-12	ı	LE-12	0.0174
LW-13	ł	LH-13	0.0383	Position	dn +	_			
LW-14	ı	LH-19	0.0647	LWF-1	1				
LW-15	1	LH-20	0.1057	LWF-2	ı				
LW-16	1		F & A Defl.	LWF-3	ı				
LW-17	1		+ Aft	LWF-4	ľ				
LW-18	1			Pitcl	Pitch Fan				
LW-19	l	LH-14	0.2581		Vert. Defl.				
LW-20	Ì	LH-15	0.2581	Position	+ Up				
LW-21	ı	LH-16	0.2581	NF-1	1				
LW-22	1	LH-17	0.2581						
LW-23	1	LH-18	0.2581						

TABLE 9

# SYMMETRIC MODE SHAPE MODE 6 f = 36.3 cps g = 0.037

					0				
Þ	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	+ Մք	Position	4 Մp	Position	+ Up	Position	+ Up	Position	+ Up
LW-1	$\overline{0}$ . 7443	LH-1	$\tilde{0}$ , 1437	F-1	0.0562	LA-1	0.7971	LE-1	$\bar{0}$ . 1514
LW-2	$\overline{0}$ . 7354	LH-2	$\tilde{0}.1423$	F-2	$\bar{0}.0134$	LA-2	0.7292	LE-2	$ar{0}$ . 1896
LW-3	$\overline{0}$ . 7422	LH-3	$\overline{0}$ .0967	F-3	0.0417	LA-3	$\bar{0}.6286$	LE-3	$\overline{0}$ . 1292
LW-4	0.5863	LH-4	0.0906	F-4	$\overline{0}$ .0056	LA-4	0.8333	LE4	$\overline{0}$ . 1597
LW-5	$\overline{0}$ . 5986	LH-5	$\overline{0}$ .0630	F-5	0.0952	LA-5	0.4870	LE-5	$\overline{0}$ . 0833
LW-6	$\overline{0}$ . $\overline{5581}$	LH-6	$\overline{0}.0480$	F-6	0.0979	I.A-6	0.9201	LE-6	$ar{0}$ . 1028
LW-7	0.4448	LH-7	$\overline{0}$ .0514	F-7	0.0299	LA-7	$\overline{0}.3434$	LE-7	$ar{0}$ .0424
LW-8	0.4722	LH-8	0.0424	F1-8	$\bar{0}$ .0375	LA-8	0.9201	LE-8	$\bar{0}.0507$
LW-9	0.3969	LH-9	$\overline{0}$ .0146	F-9	$\tilde{0}.0715$	LA-9	$\bar{0}$ . 2850	LE-9	0.0118
LW-10	$\overline{0}.3196$	LH-10	0.0333	F-10	$\overline{0}$ , 0368	LA-10	0.9722	LE-10	0.0153
LW-11	0.3576	LH-11	0.0096	Win	Wing Fan	LA-11	0.2652	LE-11	0.0361
LW-12	0.2583	LH-12	$\overline{0}$ .0340		Vert. Defl.	LA-12	1.0000	LE-12	0.0458
LW-13	0.2129	LH-13	0.0269	Position	dn +	-			
LW-14	$\overline{0}$ . 2569	LH-19	$\bar{0}.0278$	LWF-1	0.1514				
LW-15	$\bar{0}$ . 1447	LH-20	$\overline{0}$ .0201	LWF-2	0.2000				
LW-16	$\bar{0}$ . 1059		F & A Defl.	LWF-3	0.1146				
LW-17	0.0374		+ Aft	LWF-4	0.2361				
LW-18	$\bar{0}.0222$			Pitch	Pitch Fan				
LW-19	0.0375	LH-14	$\overline{0}$ . 1345		Vert. Defl.				
LW-20	0.0360	LH-15	$\overline{0}$ . 1345	Position	+ Up				
LW-21	0.0808	LH-16	$\overline{0}$ . 1345	NF-1	0.0458				
LW-22	i	LH-17	$\overline{0}$ . 1345		-				
LW-23	_   	LH-18	$\overline{0}$ . 1345	_					

TABLE 10

SYMMETRIC MODE SHAPE MODE 7 f = 44.7cps g = 0.068

				a ration &					
Δ.	Wing	Horiz.	z. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	4 Up	Position	+ Up	Position	+ Up	Position	+ Up	Position	dn +
LW-1	0.1857	LH-1	0.1141	F-1	0.0994	I-VT	0.2286	LE-1	0.1393
LW-2	0.1335	LH-2	0.1386	F-2	$\overline{0}$ .0444	LA-2	1.0000	LE-2	0.1657
LW-3	0.1001	LH-3	0.0828	F-3	0.0818	LA-3	$\bar{0}$ . 2950	LE-3	0.1250
LW-4	0.3233	LH-4	0.1082	F-4	$\overline{0}$ .0534	LA-4	0.9429	LE-4	0.1514
LW-5	0.2046	LH-5	0.0558	F-5	$\bar{0}.0168$	LA-5	0.3486	LE-5	0.0978
LW-6	0.1944	PH-6	0.0820	F-6	$\bar{0}.0114$	I.A-6	0.8893	LE-6	0.1243
LW-7	0.3949	LH-7	0.0309	F-7	0.0071	LA-7	$\bar{0}$ . 4129	LE-7	0.0736
LW-8	0.2381	LH-8	0.0331	F1 - 8	0.0314	I.A-8	0.8679	LE-8	0.1000
LW-9	0.2519	LH-9	0.0599	F-9	0.0686	LA-9	$\bar{0}.4450$	LE-9	0.0440
LW-10	0.4121	LH-10	0.0102	F-10	0.0414	LA-10	0.8214	LE-10	0.0714
LW-11	0.2344	LH-11	0.0386	Win	Wing Fan	LA-11	0.4500	LE-11	0.0315
LW-12	0.2809	LH-12	0.0354		Vert. Defl.	LA-12	0.8021	LE-12	0.0604
LW-13	0.3874	LH-13	0.0286	Position	dn +	_	•		
LW-14	0.1944	LH-19	0.0143	LWF-1	0.0821				
LW-15	0.2846	LH-20	0.0043	LWF-2	$\bar{0}.0964$				
LW-16	0.3192		F & A Defl.	LWF-3	$\bar{0}$ . 1464				
LW-17	0.2611		+ Aft	LWF-4	$\bar{0}.0643$				
LW-18	0.2293			Pitcl	Pitch Fan				
LW-19	0.2143	LH-14	0.0637		Vert. Defl.				
LW-20	0.1366	LH-15	0.0637	Position	+ Up				
LW-21	0.1496	LH-16	0.0637	NF-1	0.0586				
LW-22	1	LH-17	0.0637						
LW-23	1	LH-18	0.0637		_				

### SYMMETRIC MODE SHAPE MODE 8

				f = 55.9 c	f = 55.9 cps g = 0.033				
•	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	dn +	Position	+ Up	Position	+ Up	Position	+ Up	Position	dn +
LW-1	$\bar{0}.2775$	LH-1	0.5141	F-1	0.0168	LA-1	$\bar{0}.3033$	LE-1	0.2684
LW-2	0.2562	LH-2	0.2916	F-2	$\bar{0}.0110$	LA-2	$\bar{0}$ . 5990	LE-2	0.3123
LW-3	0.2360	LH-3	0.3335	F-3	$ar{0}$ .0200	LA-3	$\tilde{0}$ . 2904	LE-3	0.1036
LW-4	$\frac{0}{2}$ . 2479	LH-4	0.0458	F-4	$\overline{0}$ .0226	LA-4	0.7528	LE-4	0,1058
LW-5	$\frac{0}{2}$ . 2284	LH-5	0.1878	F~5	0.0045	LA-5	$\bar{0}$ . 2646	LE-5	$\bar{0}$ . 1536
LW-6	$\frac{1}{0}$ . 2069	PH-6	$\overline{0}$ . 1393	F-6	0.0019	I.A-6	$\bar{0}.4754$	LE-6	$\bar{0}$ . 2112
LW-7	0.2181	LH-7	0.2542	F-7	$\bar{0}$ .0161	LA-7	$\overline{0}$ . 2420	LE-7	$\bar{0}.3243$
LW-8	0.2000	LH-8	0.0770	F-8	0.0277	LA-8	0.2934	LE-8	$ar{0}.4136$
LW-9	0.1786	LH-9	$\bar{0}$ . 2635	F-9	0.0290	LA-9	$ar{0}$ . 2194	LE-9	$\bar{0}.4388$
LW-10	0.1882	LH-10	0.1652	F-10	$\bar{0}.0064$	LA-10	0.7983	LE-10	$ar{0}$ .4982
LW-11	0.1710	LH-11	0.3149	Win	Wing Fan	LA-11	$\tilde{0}.2065$	LE-11	$\tilde{0}.3775$
LW-12	0.1511	LH-12	0.1361		Vert. Defl.	LA-12	1.0000	LE-12	$ar{0}$ . 4252
LW-13	0.1589	LH-13	0.3259	Position	4 Up				
LW-14	0.1420	LH-19	0.0277	LWF-1	0.0458				
LW-15	0.1249	LH-20	900000	LWF-2	$\bar{0}.0536$				
LW-16	$\frac{0.1238}{1.000}$		F & A Defl.	LWF-3	0.0419				
LW-17	0.0947		+ Aft	LWF-4	$\overline{0}$ .0426				
LW-18	$\frac{0.0892}{1}$			Pitc	Pitch Fan				
LW-19	0.0658	LH-14	$\bar{0}$ . 0439		Vert. Defl.				
LW-20	0.0566	LH-15	0.0439	Position	+ Up				
LW-21	0.0399	LH-16	0.0439	NF-1	0.0103				
LW-22	<b>I</b>	71-H-17	0.0439						
LW-23		LH-18	0.0439		_				

### SYMMETRIC MODE SHAPE MODE 9 f = 67.8 cps g = 0.031

				0.10 - 1	700.0 - 9 sda 0.10				
<b>D</b>	Wing	Horiz	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defi.		Vert. Defl.		Vert. Defi.		Vert. Defl.		Vert. Defl.
Position	dn +	Position	+ Up	Position	+ Up	Position	+ Up	Position	+ Up
LW-1	0.5975	LH-1	0.0207	F-1	0.1230	LA-1	0.8363	LE-1	0.0186
LW-2	0.6500	LH-2	0.0142	F-2	$\overline{0}$ . 1013	LA-2	1.0000	LE-2	0.0308
LW-3	0.6925	LH-3	0.0176	F-3	$\bar{0}.0934$	LA-3	0.5034	LE-3	$ar{0}$ , 0175
LW-4	0.1122	LH-4	0.0138	F-4	0.0184	LA-4	0.6842	LE-4	0.0300
LW-5	0.1697	LH-5	$\overline{0}$ . 0153	F-5	0.0371	LA-5	0.2078	LE-5	$\bar{0}$ .0153
LW-6	0.2172	LH-6	$\overline{0}$ .0134	F-6	0.0196	LA-6	0.4079	LE-6	0.0286
LW-7	$\overline{0}$ . 1921	LH-7	0.0234	F-7	0.0103	LA-7	$\bar{0}$ . 1268	LE-7	$ar{0}$ , 0132
LW-8	0.1474	LH-8	0.0133	F-8	0.0011	LA-8	$\overline{0}$ . 2303	LE-8	0.0271
LW-9	0.0895	LH-9	0.0132	F-9	0.0071	LA-9	$ar{0}$ . 2976	LE-9	$\overline{0}$ .0100
LW-10	0.3479	LH-10	0.0172	F-10	$\overline{0}.0203$	LA-10	$\bar{0}.3947$	LE-10	0.0249
LW-11	0.3079	LH-11	0.0128	Win	Wing Fan	LA-11	$\bar{0}.3837$	LE-11	$\bar{0}$ .0080
LW-12	0.2568	LH-12	0.0150		Vert. Defl.	LA-12	$\bar{0}.4947$	LE-12	0.0234
LW-13	$\overline{0}$ .3875	LH-13	$\bar{0}.0124$	Position	+ Up		•		
LW-14	$\bar{0}$ . 3553	LH-19	0.0125	LWF-1	0.1579				
LW-15	$\overline{0}.3137$	LH-20	$\overline{0.0125}$	LWF-2	0.2237				
LW-16	0.3308		F & A Defl.	LWF-3	0.1237				
LW-17	$\overline{0}$ . 2814		+ Aft	LWF-4	0.1303				
LW-18	0.2079	LH-14	-	Pitcl	Pitch Fan				
LW-19	0.1842	LH-15	1		Vert. Defl.				
LW-20	$\overline{0}$ .0867	LH-16	ı	Position	4 Up				
LW-21	0.0782	LH-17	ı	NF-1	0.0882				
LW-22	1	LH-18	ı						
LW-23	1	_	_ 						

### SYMMETRIC MODE SHAPE MODE 10 f = 90.3 cps g = 0.031

				0	10010 8 -1				
15	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	+ Up	Position	t Lip	Position	. + Up	Position	4 Up	Position	
LW-1	ı	LH-1	0.5083	F-1	1	LA-1	l	LE-1	0.7170
LW-2	1	LH-2	0.6187	F-2	ı	LA-2	ı	LE-2	1.0000
LW-3	ı	LH-3	0.3619	F-3	1	LA-3	ı	LE-3	0.8679
LW-4	ı	LH-4	0.2383	F-4	ı	LA-4	ı	LE-4	0.9811
LW-5	ı	LH-5	$\overline{0}$ . 2419	F-5	0.000	LA-5	ı	LE-5	0.6226
LW-6		1.H-6	0.0475	F-6	0.0206	LA-6	ı	LE-6	0.7170
LW-7	1	LH-7	$\overline{0}$ .1630	F-7	0.0725	LA-7	ı	LE-7	0.0943
LW-8	1	LH-8	$\bar{0}$ .1483	F-8	$\bar{0}.0389$	LA-8	ì	LE-8	0.2736
LW-9	ı	LH-9	0.2394	F-9	$\bar{0}$ . 1985	LA-9	ı	LE-9	0.5660
LW-10	ł	LH-10	0.0951	F-10	0.1225	LA-10	ı	LE-10	$\frac{1}{0}$ . 5660
LW-11	ı	LH-11	0.3370	Win	Wing Fan	LA-11	ı	LE-11	0.4717
LW-12	1	LH-12	0.2366		Vert. Defl.	LA-12	i	LE-12	0.4717
LW-13	1	LH-13	$\bar{0}$ .3396	Position	4 Up	-			•
LW-14	ı	LH-19	0990.0	LWF-1					
LW-15	ļ	LH-20	0.0189	LWF-2	ı				
LW-16	1		F & A Defl.	LWF-3	1				
LW-17	1		+ Aft	LWF-4	١				
LW-18	ı	LH-14	0.1142	Pitcl	Pitch Fan				
LW-19	ı	LH-15	0.1142		Vert. Defl.				
LW-20	ı	LH-16	0.1142	Position	/+ Up				
LW-21	ı	LH-17	0.1142	NF-1	1				
LW-22	ı	LH-18	0.1142						
LW-23	_ 								

TABLE 14

## ANTISYMMETRIC MODE SHAPE MODE 1 f = 8.8 cps g = 0.030

-	Wing	Horiz	Horiz. Stab.	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Ruc	Rudder
	Vert. Defl.		Vert. Defl.	L	Lat. Defl.		Lat. Defl. Ang. Defl	Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Defl.
Position	4 Up	Position	+ Up	Position	+ Left	Position		X103*	Position	dn +	Position	+ Up	Position	+ Left
LW-1	0.2549	LH-1	0.9689	V-1	0.0525	F-11-12	6.2062	0.3891	LA-1	0.3268	LE-1	0.9844	R-1	0.6089
L.W-2	0.2665	LH-2	1.0000	V-2	ō.0895	F-13-14	0.1370	0.3891	LA-2	0.3502	LE-2	0.9844	R-2	0.6089
LW-3	0.2588	LH-3	0.7782	V-3	0.0946	F-15-16	0.0428	0.3891	LA-3	0.3016	LE-3	0.8949	R-3	0.4786
LW-4	0.2140	1-H-1	0.8171	V-4	0.1304	F-17-18	0.000	0.3891	LA-4	0.3230	LE-4	0.8949	R-4	0.4786
LW-5	0.2245	LH-5	0.5992	V-5	6.1907	F-19-20	0.0673	0.1249	LA-5	0.2743	LE-5	0.7198	R-5	0.3696
LW-6	0.2241	9-H7	0.6304	9-A	0.2218	F-21-22	0.0860	0.6257	P-6	0.2957	LE-6	0.7198	R-6	0.3696
LW-7	0.1790	LH-7	0.4280	V-7	0.2996	F-23-24	0.0860	I.0245	LA-7	0.2374	LE-7	0.5331	R-7	0.3619
LW-8	0.1907	LH-8	0.4163	8-A	0.3307	F-25-30	0.0778	I.8482	LA-8	0.2588	LE-8	0.5331	R-8	0.3152
LW-9	0.1899	LH-9	0.4358	6-A	0.4144	F-26-31	0.0603	2.6264	LA-9	0.2101	LE-9	0.2529	R-9	0.2646
LW-10	0.1498	LH-10	0.2335	V-10	0.4552	F-27-32	0.0268	3.4630	LA-10	0.2335	LE-10	0.2529	R-10	0.2257
LW-11	0.1623	LH-11	0.2412	_	0.5447		Wing	Wing Fan	LA-11	0.1907	LE-11	0.0778	R-11	0.1732
LW-12	0.1556	LH-19	0.2335	V-12	0.6420			Vert. Defl.	LA-12	0.2179	LE-12	0.0778	R-12	0.1401
LW-13	0.1214		Lat. Defl.	V-13	0.7043		Position	+ Up						
LW-14	0.1374		+ Left	_	0.1704		LWF-1	0.4280						
LW-15	0.1237		0 8489	V-15	0.2685		LWF-2	0.6926						
LW-16	0.0918		0000		0.3813		LWF-3	0.2685						
LW-17	0.0895		0.8755	_	0.5097		LWF-4	0.2724	_					
LW-18	0.0626		F & A Defl.	_	0.0778									
LW-19	0.0595		+ AR		0.0595									
LW-20	0.0401	LH-14	0.2054	F-27	0.0245									
LW-21	0.0381	LH-15	0.3716											
LW-22		LH-16	0.5377											
LW-23		LH-17	0.7039	2							*			
	F & A Defl.	LH-18	0.8700											
LW-24	0.2288	_												
LW-25	0.1821													
LW-26	0.1362													
LW-27	0.0825	_												

### ANTISYMMETRIC MODE SHAPE MODE 2 f = 11.9 cps g = 0.045

Vert. Defi.		9		noriz. Stab.		Vert. Stab.	Fu	Fuselage (WL 100)	. 100)	Ai	Aileron	213		ľ	1
0. 0465         LH-1         0. 5833         V-1         0. 0239         F-11-14         0. 0321         C-1-1         0. 0455         LH-1         0. 5833         V-2         0. 0239         F-11-14         0. 0320         C-1-1         0. 0425         LH-2         0. 0425         LH-3         0. 0426         LH-3		Vert. Defl.		Vert. Defl.		Lat. Defl.		Lat Defi	Ana Dati			Elia	Vator	×	Rudder
0.0455 LH-1	Positio	. 1	Position	_		+ Left	Position	+ Left			vert. Defl.	Position	Vert. Defl.		_
0.0451         LH-2         0.5883         V-2         0.035         F-13-14         0.036         LA-2         0.0478         LE-1         0.0478         LE-1         0.0478         LE-2         0.035         LA-2         0.0478         LE-1         0.0478         LE-2         0.035         LA-2         0.0478         LE-3         0.0478         LE-3         0.0436         LE-3         0.0439         LE-3         0.04478         LE-3         0.04448         LE-3         0.04448         LE-3	LW-1	0.0465	LH-1	0. 5833	V-1	0.0239	F-11-19		_			TO STRICT		Position	+ Len
0.0475         LH-3         0.4720         V-3         0.0429         F-15-16         0.0350         LA-2         0.0602         LE-2         0.0430         LH-3         0.0430         LH-3         0.0431         LE-3         0.0431         LE-3         0.0431         LH-3         0.0435         LH-3         0.0431         LH-3         0.0434         LH-3         0.0435         LH-3         0.0436         LH-3         <	LW-2	0.0451	LH-2	0.5833	V-2	0 0038			0.0182	1-4-1	0.0418	LE-1	0. 5355	R-1	0.0363
0.0382         LH-4         0.1700         V-4         0.0435         F-15-10         0.0034         0.0431         LA-5         0.0411         LB-8           0.0373         LH-4         0.1400         V-5         0.0430         F-19-20         0.0371         LA-4         0.0435         LE-4           0.0382         LH-6         0.3605         V-6         0.0669         F-21-22         0.0046         0.0374         LA-5         0.0345         LE-6           0.0300         LH-7         0.2492         V-9         0.0668         F-21-22         0.0046         0.0347         LA-6         0.0436         LE-6         0.0438         LE-6           0.0300         LH-8         0.2492         V-9         0.0918         F-22-34         0.0049         LA-7         0.0495         LA-9         0.0495         LB-1           0.0239         LH-10         0.1377         V-11         0.0718         LA-7         0.0495         LA-1         0.049	LW-3	0.0478	LH-3	0.4720	7.3	0000	11-01-1	0.0208	0.0320	LA-2	0.0602	LE-2	0.4877	R-2	0.0478
0.0372         LH-1         0.150         V-4         0.1540         F-17-18         0.0231         LA-4         0.0545         LE-5           0.0372         LH-6         0.3605         V-6         0.0105         F-12-2         0.0044         0.0371         LA-7         0.0354         LE-5           0.0300         LH-7         0.2492         V-7         0.0066         F-21-22         0.0046         0.0316         LA-7         0.0354         LA-7         0.0354         LA-7         0.0354         LA-7         0.0354         LA-7         0.0359         LA-7         0.0359         LA-7         0.0354         LA-7         0.0354         LA-7         0.0359         LA-7         0.0359         LA-7         0.0359         LA-7         0.0359         LA-7         0.0359         LA-7         0.0359         LA-8         0.0359         LA-9         0.0257         F-25-30         0.0359         LA-9         0.0259         LB-9         0.0259         LB-9 <t< td=""><td>LW-4</td><td>0.0382</td><td>1 H-4</td><td>22.00</td><td></td><td>0.0249</td><td>91-01-4</td><td>0.0024</td><td>0.0073</td><td>LA-3</td><td>0.0411</td><td>LE-3</td><td>0. 4838</td><td>B-3</td><td>0</td></t<>	LW-4	0.0382	1 H-4	22.00		0.0249	91-01-4	0.0024	0.0073	LA-3	0.0411	LE-3	0. 4838	B-3	0
0.0382	TWI			07:4:50	*	0.0430	F-17-18	0.0023	0. 0371	LA-4	0.0545	1.5			
0.0332 LH-6 0.3605 V-6 0.0669 F-21-22 0.0046 0.0316 LA-7 0.0239 LE-7 0.0306 LH-9 0.2492 V-7 0.0086 F-23-24 0.0094 LA-7 0.0239 LE-7 0.0306 LH-9 0.2492 V-9 0.0277 F-26-31 0.0325 LA-9 0.0229 LH-10 0.1377 V-10 0.0214 F-27-32 0.0495 LA-10 0.0229 LH-11 0.1377 V-11 0.0516 Wing Fan LA-11 0.0229 LH-12 0.0394 LH-13 0.0494 LH-13 0.0494 LH-14 0.0315 F-27 0.0494 0.0314 LH-15 0.0394 LH-16 0.0315 F-27 0.0494 0.0314 LH-17 0.0394 LH-18 0.0494 0.0314 LH-18 0.0394 LH-19 0.0395 LH-19 0.0	2	0.0373	LH-5	0.3605	V-5	0.0103	F-19-20	0.0084	0.0302	1.4-5	0.00		4388	H-4	0.0191
0.0300 LH-7 0.2492 V-7 0.0086 F-23-24 0.0091 LA-9 0.0478 LE-6 0.0300 LH-8 0.2492 V-8 0.0918 F-23-24 0.0850 0.00710 LA-9 0.0289 LE-7 0.0306 LH-9 0.2492 V-9 0.0277 F-26-31 0.0352 0.1100 LA-9 0.0289 LE-9 0.0239 LH-11 0.1377 V-12 0.0516 T-27-32 0.0489 LA-11 0.0287 LE-9 0.0239 LH-13 0.1377 V-12 0.0516 T-27-32 0.0489 LA-11 0.0287 LE-12 0.0289 LH-13 0.0177 V-12 0.00516 T-27-32 0.0489 LH-13 0.0768 V-13 0.0101 LA-12 0.0889 LH-13 0.0768 V-13 0.0101 LA-12 0.0889 LH-14 0.0568 V-15 0.0089 LH-14 0.0568 V-15 0.0089 LH-14 0.0568 V-15 0.0089 T-27 0.0098 T-27 0.0089 T-27 0.0099 T-	FW-9	0.0382	FH-6	0.3605	9-1	0.0669	F-91-99	0 0016	0.00		0.0004	FE-3	0.3787	R-5	0.019
0.0300         LH-8         0.2492         V-8         0.0375         F-25-24         0.0235         0.100         LA-7         0.0289         LE-7           0.0306         LH-9         0.2492         V-9         0.0277         F-26-31         0.0235         0.1100         LA-9         0.0229         LE-9           0.0239         LH-10         0.1377         V-10         0.1243         F-26-31         0.0350         LA-10         0.0229         LE-9           0.0239         LH-11         0.1377         V-12         0.0276         F-27-32         0.0495         LA-10         0.0229         LE-10           0.0184         LH-12         0.1377         V-12         0.0705         V-12         0.0705         LA-11         0.0287         LA-11         0.0287         LA-12         0.0289         LE-10           0.0194         LH-12         0.566         V-15         0.0287         LWF-1         0.0186         LWF-1         0.0289         LR-12         0.0249         LE-11           0.0057         LH-13         0.766         V-15         0.0289         LWF-1         0.0421         LWF-1         0.0421           0.0059         LH-14         0.2156         F-27 <t< td=""><td>LW-7</td><td>0.0300</td><td>LH-7</td><td>0.2492</td><td>V-7</td><td>9800 0</td><td>F-00-01</td><td>00000</td><td>0.0316</td><td>9-4-</td><td>0.0418</td><td>P-37</td><td>0.3481</td><td>R-6</td><td>0.0000</td></t<>	LW-7	0.0300	LH-7	0.2492	V-7	9800 0	F-00-01	00000	0.0316	9-4-	0.0418	P-37	0.3481	R-6	0.0000
0.0306         LH-9         0.2492         V-9         0.0215         F-25-30         0.1035         LH-8         0.0325         LH-9         0.0274         F-25-30         0.0235         LH-9         0.0277         F-27-30         0.0235         LH-9         0.0277         F-26-31         0.0352         LH-9         0.0277         F-26-31         0.0352         LH-9         0.0277         F-26-31         0.0352         LH-10         0.0277         F-26-31         0.0352         LH-10         0.0277         LH-10         0.0277         F-26-31         0.0495         LH-10         0.0276         LH-10         0.0279         LH-11         0.0276         LH-11         0.0276         LH-11         0.0276         LH-11         0.0276         V-14         0.015         LWF-1         0.0380         LH-11         0.0276         LWF-1         0.0382         LM-11         0.0276         LWF-1         0.0382         LM-1         LM-11         0.0276         LWF-2         0.0382         LWF-3         0.0382         LM-1         LM-1         LM-1         0.0276         LWF-3         0.0382         LM-1         0.0276         LWF-3         0.0382         LM-1         0.0276         LWF-3         0.0382         LM-1         0.0276         LWF-3	LW-8	0.0300	LH-8	0 0499	0.7	0000	17-07-1	0.000	0.0014	LA-7	0.0289	LE-7	0.2754	R-7	0.098
0.0229 LH-10 0.1377 V-10 0.1243 F-27-32 0.1893 LA-9 0.0229 LE-9 0.0239 LH-10 0.1377 V-11 0.0516 V-11 0	LW-9	0.0306	LH-9	0 0400	0 0	0.0919	DE-62-4	0.0235	0.1100	8-K1	0.0325	LE-8	0.2544	R-R	0.00
0.0239         LH-11         0.1371         V-12         0.0143         F-27-32         0.0495         LA-10         0.0287         LE-10           0.0239         LH-13         0.1377         V-12         0.0708         Ming Fan         LA-11         0.0287         LE-12           0.0184         LH-19         0.1377         V-12         0.0708         Position         + Up         LA-12         0.0289         LE-11         0.0289         LE-12         LA-12         0.0249         LE-12           0.0184         LH-12         0.5068         V-15         0.0287         LWF-2         0.1186         LA-12         0.0249         LE-12           0.0184         LH-13         0.765         V-17         0.088         LWF-3         0.0382         LWF-3         0.0382           0.0029         LH-14         0.2360         F-26         0.0459         LWF-4         0.0421         LWF-4         0.0421           F&A Deff.         F-27         0.0493         LWF-4         0.0421         LWF-4         0.0421           F & A Deff.         LH-16         0.6181         F-27         0.0493         LWF-4         0.0421           +Aft         LH-18         1.0000         LH-18	LW-10	0.0229	1.H-10	2000		0.0277	F-26-31	0.0352	0.1893	LA-9	0.0229	LE-9	0.1300	B-0	200
0.0239         LH-19         0.1377         V-11         0.036         Wing Fan         LA-11         0.0218         LE-12           0.0184         LH-19         0.1377         V-12         0.0708         Vert. Defl.         LA-12         0.0249         LE-12           0.0189         LH-12         0.5068         V-13         0.1071         Position         +Up         LA-12         0.0249         LE-12           0.0199         LH-12         0.5068         V-15         0.0297         LWF-2         0.1186         LE-12         LE-12           0.0134         LH-12         0.5068         V-16         0.0287         LWF-3         0.0382         LWF-3         0.0382           0.0057         LH-13         0.0765         V-17         0.0688         LWF-3         0.0421         LWF-3         0.0421           0.0049         LH-14         0.2360         F-26         0.0352         LWF-4         0.0421         LWF-3         0.0421           - LH-15         0.6181         F-27         0.0493         LWF-4         0.0421         LWF-4         0.0421           +Aft         LH-18         1.0000         LH-18         1.0000         LWF-4         0.0421	LW-11	0 0239	1		01-1	0.1243	F-27-32	0.0493	0.3060	LA-10	0.0287	LE-10	0 1147	0	
0.0184         LH-12         0.1377         V-12         0.0708         Vert. Defl.         LA-12         0.0249         LE-12           0.0184         LH-12         0.1377         V-13         0.1071         Position         V-19         0.0249         LE-12           0.0184         LH-12         0.5068         V-15         0.015         LWF-2         0.1186         LWF-2         0.0186           0.0184         LH-12         0.5068         V-16         0.0459         LWF-2         0.1186         LWF-3         0.0382         LWF-4         0.0421         LWF-3         0.0382         LWF-4         0.0421         LWF-3         0.0421         LWF-1         0.0421	LW-19	_	111111111111111111111111111111111111111	0.1377	11-	0.0516		Wing	Fan	LA-11	0.0218	I.F-11			0.0268
0.0184         Lat. Defl. v-13         v-13         0.1071         Position + Up to 0.0199           0.0199         + Left v-14         v-15         0.015         LWF-1         0.0880           0.0134         LH-12         0.5068         v-15         0.0287         LWF-2         0.1186           0.0057         LH-13         0.0765         v-17         0.0688         LWF-3         0.0382           0.0069         + Aft v-16         F-26         0.0352         LWF-4         0.0421           - LH-14         0.2356         F-27         0.0493         LWF-4         0.0421           - LH-15         0.4270         - C-193         F-27         0.0493           - Aft         LH-16         0.6181         F-27         0.0493           - Aft         LH-18         1.0000         0.0493		_	_	0. 1377	1-12	0.0708			Vert. Defl	LA-12	0 0040			11-11	0.0612
0.0199         + Left         V-14         0.0115         LWF-1           0.0191         LH-12         0.5068         V-15         0.0287         LWF-2           0.0134         LH-13         0.0765         V-16         0.0459         LWF-2           0.0057         LH-20         0.3155         F-25         0.0588         LWF-3           0.0056         LH-14         0.355         F-26         0.035         LWF-4           0.0046         LH-14         0.2360         F-27         0.0493         LWF-4           F&A Deff.         LH-16         0.691         F-27         0.0493         LWF-4           F&A Deff.         LH-16         0.691         F-27         0.0493         LWF-4           0.0404         LH-18         1.0000         LH-18         1.0000         LH-18         0.0493	- N-13	0.0184		Lat. Defl.	V-13	0.1071		_	+ I'i		6170.0	LE-12	0.0268	R-12	0.0402
0.0191 LH-12 0.5068 V-15 0.0287 LWF-2 0.0134 LH-13 0.0765 V-16 0.0459 LWF-3 0.0056 0.0057 LH-14 0.235 0.0058 LH-14 0.2350 0.0048 LH-15 0.4270 LH-15 0.6181 F-27 0.0493 LH-15 0.6181 F-27 0.0493 LH-15 0.0591 LH-15 0.0591 LH-15 0.0591 CH-15 0.0591 CH-15 0.0591 CH-15 0.0591 CH-15 0.0591 CH-15 0.0541 CH-15 0.0541 CH-15 0.0541	- N-	0.0199		+ Left	V-14	0.0115	1_	LWF-1	0000						
0.0109 LH-12 0.0765 V-16 0.0459 LWF-3 0.0134 LH-20 0.3155 F-25 0.0288 LWF-4 0.0057 LH-14 0.2360 0.0048 LH-14 0.2360 0.0048 LH-14 0.2360 0.0048 LH-15 0.6181 F-27 0.0493 LH-16 0.6181 LH-17 0.8091 LH-18 1.0000 0.0041 LH-18 1.0000 0.0241 0.0241	CI-MT	0.0191		9905 0	V-15	0.0287			0000						
0.0134 LH-13 0.0765 V-17 0.0688 LWF-4 0.0057 LH-20 0.3155 F-25 0.0235 0.0058 0.0048 LH-14 0.2360 F-27 0.0493 CH-13 0.0414 LH-15 0.0091 LH-15 0.0091 LH-15 0.0091 CH-13 0.0049	LW-16	0.0109	71-17		V-16	0.0459		Z-1 W 1	0. 1186						
0.0057 LH-20 0.3155 F-25 0.0235 LWF-4 0.0029 LH-14 0.2360 C.0493 LH-15 0.4270 LH-15 0.6181 F-27 0.0493 LH-16 0.6181 F-27 0.0494 0.0321 0.0241 0.0145	LW-17	0.0134	EH-13	0.0765	V-17	9900		LWF-3	0.0382						
0.0086 1.44 0.2360 0.0029 1.H-14 0.2360 1.H-15 0.4270 1.H-16 0.6181 1.H-17 0.8091 1.H-18 1.0000 0.0404 0.0221 0.0241	LW-18	0.0057	LH-20	0.3155	F-95	0000	-	LWF-4	0.0421						
0.0029 +Aft F-27  - LH-14 0.2360 - LH-15 0.4270 - LH-16 0.6181  +Aft LH-17 0.8091  0.0404  0.0221  0.0241	LW-19	0.0086	-	F& A Deft.	F-96	0.0250									
0.0048 LH-14 0.2360 LH-15 0.4270 LH-16 0.6181 +Aft LH-17 0.8091 0.0404 0.0221 0.0241	LW-20	0.0029	-	+ Aft	F-27	0.000									
- LH-15 - LH-16 - LH-17 + Aft 0.0404 0.0321 0.0241	LW-21	0.0048	LH-14	0.2360		0.000									
- LH-16 + Aft LH-17 + Aft LH-18 0.0404 0.0321 0.0241	LW-22	,	LH-15	0.4270											
F& A Deff. LH-17 + Aff LH-18 0.0404 0.0221 0.0241	LW-23	,	LH-16	0.6181											
+ Aff LH-18 0.0404 0.0321 0.0241 0.0145		F& A Deff.	LH-17	0.8091											
		+ Aft	LH-18	1.0000											
	LW-24	0.0404													
	LW-25	0.0391													
	LW-26	0 0941													
-	. A	120.0													
	-	0.0140													

#### ANTISYMMETRIC MODE SHAPE MODE 3 f = 14.5 cps g = 0.023

N	Wing	Horiz	Horiz. Stab.	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Ruc	Rudder
	Vert. Defl.		Vert. Defl.		Lat. Defl.		Lat. Defl. Ang. Defl	Ang. Defl.		Vert. Defil.		Vert. Defl.		Lat. Defl.
Position	+ Up	Position	+ Up	Position	+ Left	Position	+ Left	X103.	Position	+ Cp	Position	+ Up	Position	+ Left
LW-1	0.0450	LH-1	1.0000	V-1	0.3413	F-11-12	0.2026	0.4158	LA-1	0.0413	LE-1	0.9587	F-1	0.3357
LW-2	0.0390	LH-2	0.8948	V-2	0.3788	F-13-14	0.1290	0.4524	LA-2	0.0413	LE-2	0.9782	F-2	0.3151
LW-3	0.0405	LH-3	0.8091	V-3	0.4492	F-15-16	0.0210	0.1662	LA-3	0.0353	LE-3	0.8667	F-3	0.4032
F-M-1	0.0413	THE	0.7239	V4	0.3563	F-17-18	0.0210	6.0803	LA-4	0.0353	LE-4	0.8843	F-4	0.3751
LW-5	0.0323	LH-5	0.6180	V-5	0.4351	F-19-20	0.0315	0.8730	LA-5	0.0304	LE-5	0.6868	F-5	0.4482
9-M7	0.0338	9-H7	0.5529	9-1	0.3638	F-21-22	0.0375	0.8740	LA-6	0.0304	P-9-37	0.7009	F-6	0.4107
LW-7	0.0381	LH-7	0.3563	V-7	0.4164	F-23-24	0.1440	0.4242	LA-7	0.0246	LE-7	0.5071	F-7	0.4623
LW-8	0.0268	LH-S	0.4270	8-7	0.3601	F-25-30	0.2626	0.2251	LA-8	0.0246	F-8	0.5173	F-8	0.4276
FW-9	0.0285	LH-9	0.3820	6-A	0.3798	F-26-31	0.3526	0.7502	LA-9	0.0208	LE-9	0.2410	F-9	0.4745
LW-10	0.0341	LH-10	0.1969	V-10	0.3441	F-27-32	0.4411	1.4398	LA-10	0.0208	LE-10	0.2461	F-10	0.4464
LW-11	0.0231	LII-III	0.2112	V-11	0.3320		Wing	Wing Fan	LA-11	0.0189	LE-11	0.0671	F-11	0.4839
LW-12	0.0231	LH-19	0.2361	V-12	0.2907			Vert. Defl.	LA-12	0.0189	LE-12	0.0686	F-12	0.4632
LW-13	0.0300		Lat. Defil.	V-13	0.2701		Position	4 Up						
LW-14	0.0191		+ Left	V-14	0.3807		LWF-1	0.1838						
LW-15	0.0191			V-15	0.3788		LWF-2	0.2251						
LW-16	0.0259	LH-12	0.2626	V-16	0.3620		LWF-3	0.11.5						
LW-17	0.0150	LH-13	0.1875	V-17	0.3310		LWF-4	0.1107						
LW-18	0.0206	LH-20	0.2251	F-25	0.2626									
LW-19	0.0109		F & A Defl.	F-26	0.3524									
LW-20	0.0150		+ Aft	F-27	0.4432									
LW-21	0.0071	LH-14	0.1510											
LW-22	ı	LH-15	0.2733											
LW-23		LH-16	0.3955											
	F & A Defl.	LH-17	0.5178											
	+ Aft	LH-18	0.6399											
LW-24	0.1002													
LW-25	0.0797													
LW-26	0.0296													
LW-27	0.0356													

· Left Wing Down

# ANTISYMMETRIC MODE SHAPE MODE 4 f = 18.5 cps g = 0.046

c		Wing	Horiz	Horiz. Stab.	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Ru	Rudder
1. Up   Position   4 Up   Po		Vert. Defl.		Vert. Defi.		Lat. Defl.		Lat. Defl.	Ang. Deft.		Vert. Defl.		Vert. Defl.		Lat. Defl.
0.6114         LH-1         0.4436         V-1         0.0143         F-II-12         0.1518         4.617         LA-1         0.7130         LE-1         0.4568         R-1           0.6114         LH-2         0.4839         V-2         0.0124         F-II-16         0.0247         1.0000         LE-2         0.4664         R-2           0.4267         LH-3         0.3375         V-3         0.0147         F-II-16         0.0247         LA-3         0.6167         LE-3         0.4664         R-3           0.4584         LH-4         0.3867         V-4         0.0457         F-11-26         0.0256         LR-4         0.9116         LE-3         0.4664         R-4           0.4584         LH-6         0.2304         V-6         0.0457         F-12-26         0.0256         LR-5         0.0256 </th <th>Position</th> <th></th> <th>Position</th> <th>4.Cp</th> <th>Position</th> <th>+ Left</th> <th></th> <th>+ Left</th> <th>X103.</th> <th></th> <th></th> <th></th> <th>+ Up</th> <th></th> <th>+ Left</th>	Position		Position	4.Cp	Position	+ Left		+ Left	X103.				+ Up		+ Left
0.6114 1142 0.54529 V.2 0.0134 F-13-11 0.1024 3.0062 LA-2 1.0000 LE-2 0.4654 R-2 0.4259 U.4 0.5352 V.4 0.0355 V.4 0.0355 V.4 0.0355 LH-3 0.0357 V.4 0.0355 LH-3 0.0357 V.4 0.0355 LH-3 0.0357 LH-3 0.0357 V.4 0.0357 V-4 0.0357 LH-3 0.0357 LH-3 0.0357 LH-3 0.0357 V-4 0.0357 LH-3 0.0357	LW-1	0.6114	LH-1	0.4456	V-1	0.0145	F-11-12	0.1518	4.6197	LA-1	0.7130	LE-1	9.4508	R-1	0.0249
0.6777         LH-3         0.3375         V-3         \u00edata{0.0296}         F-15-16         \u00edata{0.0296}         1.4-3         0.3375         V-3         \u00edata{0.0296}         F-17-15         \u00edata{0.0296}         LH-3         0.3369         V-4         \u00edata{0.0296}         LH-4         0.3369         V-4         \u00edata{0.0297}         F-17-15         \u00edata{0.0296}         LH-4         0.3369         V-4         \u00edata{0.0297}         F-17-15         \u00edata{0.0296}         LH-4         0.3407         LH-5         0.3407         LH-6         0.3407         LH-7         0.4408         LH-7         0.4408         LH-7         0.4408         LH-7         0.4408         LH-7         0.4409         LH-7         0.4409         LH-7 </td <th>LW-2</th> <td>0.6114</td> <td>LH-2</td> <td>0.4829</td> <td>V-2</td> <td>0.0124</td> <td>F-13-11</td> <td>0.1024</td> <td>3.6062</td> <td>LA-2</td> <td>1.0000</td> <td>LE-2</td> <td>0.4684</td> <td>R-2</td> <td>0.0383</td>	LW-2	0.6114	LH-2	0.4829	V-2	0.0124	F-13-11	0.1024	3.6062	LA-2	1.0000	LE-2	0.4684	R-2	0.0383
0.4529         LH-1         0.3859         V-4         0.0332         F-17-15         0.0247         3.9026         LR-4         0.9199         LE-5         0.3067         R-7           0.4534         LH-5         0.2304         V-5         0.0487         F-19-20         0.0332         B-1         B-5         0.3067         R-5           0.5533         LH-6         0.2304         V-7         0.0083         F-23-24         0.0480         LR-6         0.3171         R-6           0.3320         LH-6         0.1313         V-5         0.0883         F-23-24         0.0598         LR-7         0.3171         R-6           0.3320         LH-10         0.1579         V-9         0.0280         F-23-24         0.0791         LR-7         0.117         R-6           0.3320         LH-10         0.1579         V-10         0.0429         F-23-24         0.0794         LR-7         0.0591         R-8         0.0331         R-9           0.3320         LH-10         0.0568         V-12         0.0412         F-23-23         0.0591         LR-10         0.0331         R-10           0.3325         LH-13         0.0757         V-13         0.0412         F-23-23	LW-3	0.6777	LH-3	0.3378	V-3	0.0477	F-15-16	0.0398	3,6197	LA-3	0.6176	LE-3	0.4000	B-3	0.0062
0.4654         LH-5         0.2104         V-5         0.0157         F-19-20         0.0337         LA-5         0.0258         LE-5         0.0307         R-5           0.5533         LH-6         0.2324         LH-6         0.0437         V-7         0.0497         F-21-22         0.0457         LH-6         0.0559         LE-6         0.0371         R-5           0.3420         LH-8         0.1313         V-8         0.0457         F-21-22         0.0459         LR-7         0.0459         LR-7         0.0459         LR-7         0.0459         LR-7         0.0559         LR-7         0.0459         LR-8         0.0559         LR-8         0.0559         LR-8         0.0559         LR-8         0.0559         LR-8         0.0559         LR-8         0.0559         LR-9         0.0559         LR-1         0.0559         LR-1         0.0559         LR-1         0.0559         LR-1         0.0559         LR-1         0.0559         LR-1         0.0	LW-4	0.4269	LH-1	0.3689	7-1	0.0352	F-17-18	0.0247	3,9026	LA-4	0.9119	LE-4	0.4166	7-2	0.0135
0.5533         LH-6         0.2932         V-6         0.0197         F-21-22         0.0452         LA-6         0.8290         LE-6         0.3171         R-6           0.2853         LH-7         0.1492         V-7         0.0058         F-21-22         0.0522         2.8062         LA-7         0.1044         LE-7         0.2176         R-7           0.3420         LH-8         0.1059         V-9         0.0280         F-23-24         0.0521         LA-9         0.0347         LE-9         0.0331         LE-10         0.0331	LW-5	0.4684	CH-5	0.2404	V-5	0.0187	F-19-20	0.0332	3, 2974	LA-5	0.5285	LE-5	0.3067	R-5	0.0332
0.2653         LH-7         0.1492         V-7         0.0083         F-23-24         0.0622         2.8662         LA-7         0.1104         LE-7         0.2176         R-7           0.3420         LH-8         0.1513         V-8         0.0580         P-25-30         0.0791         2.6513         LA-8         0.6591         LE-8         0.2176         R-8           0.1306         LH-10         0.0508         V-10         0.0520         F-25-30         0.0701         LA-10         0.5397         LE-10         0.0338         R-9           0.1306         LH-10         0.0506         V-12         0.0404         F-25-30         0.0406         LA-11         0.0507         LE-10         0.0338         R-9           0.3275         LH-12         0.0767         V-11         0.0404         F-26-31         0.0406         LA-11         0.0528         LE-11         0.0228         LE-11         0.0529         LE-11         0.0529         LE-11         0.0529         LE-11         0.0529         LE-11         0.0528         LE-11         0.0528         LE-11         0.0528         LE-11         0.0528         LE-11         0.0528         LE-11         0.0528         LE-11         0.0529         LE-11<	9-M7	0.5513	9-H7	0.2632	9-A	0.0497	F-21-22	0.0452	3.0508	L.A-6	0.8290	LE-6	0.3171	R-6	0.0104
0.3320         LH-8         0.1513         V-8         0.0550         F-25-30         0.0791         2.6913         LA-8         0.6391         LE-6         0.2228         R-8           0.4332         LH-9         0.0507         V-9         0.0550         F-25-30         0.0707         LH-9         0.0508         R-9           0.2342         LH-10         0.0508         V-11         0.0642         F-27-32         0.1096         LA-10         0.0397         LE-11         0.0998         R-10           0.3342         LH-11         0.0767         V-12         0.0415         V-11         0.0642         F-27-32         0.1091         LA-11         0.0599         R-11           0.0311         LA-12         0.0767         V-12         0.0415         LA-11         0.0599         LE-11         0.0399         LE-11         0.0998         R-11           0.0314         LH-12         0.0143         V-16         0.0425         LWF-3         0.1762         LR-12         0.0311         R-12           0.0539         LH-13         0.0143         V-16         0.0425         LWF-3         0.1762         LE-12         0.0311         R-12           0.0539         LH-13         0.	LW-7	0.2653	LII-7	0.1492	7-7	0.0083	F-23-24	0.0622	2,8062	LA-7	0.4104	LE-7	0.2176	R-7	0.0394
0.4332	8-M7	0.3420	LH-8	0.1513	8-A	0.0580	F-25-30	0.0794	2, 6943	LA-8	0.6591	LE-8	0.2228	R-8	0.0218
0.1306         LH-10         0.0808         V-10         0.0642         F-27-32         0.1056         LA-10         0.5397         LE-10         0.0995         R-10           0.2342         LH-11         0.0767         V-12         0.0415         V-27-32         0.1056         LA-10         0.5397         LE-12         0.0395         R-11           0.3275         LH-13         0.0767         V-13         0.0456         Posttion         Vert. Defil.LA-12         0.5392         LE-12         0.0311         R-12           0.1375         LH-12         0.0159         V-15         0.0301         LWF-2         0.2902         LE-12         0.0311         R-12           0.053         LH-13         0.0143         V-15         0.0301         LWF-3         0.162         LWF-3         0.162           0.054         LH-13         0.0144         V-17         0.055         LWF-4         0.1492         LE-12         0.0311         R-12           0.055         LH-14         0.0166         F-26         0.0914         LWF-4         0.1492         R-12         0.031         R-12           0.0507         LH-16         0.0435         LE-26         0.0914         R-27         0.0914	6-M7	0.4332	LH-9	0.1679	6-A	0.0280	F-26-31	0.0950	2,7606	LA-9	0.3347	LE-9	0.0933	R-9	0.0591
0.2342         LH-11         0.0767         V-11         0.0404         Wing Fan         LA-11         0.2839         LE-12         0.0258         R-11           0.3375         LH-19         0.0767         V-12         0.0415         Position         V-19         0.05492         LE-12         0.0311         R-12           0.031         LAT. Defl.         V-13         0.0426         LWF-2         0.5492         LE-12         0.0311         R-12           0.235         LH-12         0.0194         V-15         0.0301         LWF-3         0.1624         LWF-3         0.5492         R-12         0.0311         R-12           0.035         LH-13         0.0143         V-16         0.0425         LWF-4         0.1492         R-14         0.0311         LWF-4         0.1492         R-14         0.0311         R-16         0.0435         R-16         0.0435         R-14         0.044         R-16	LW-10	0.1306	LH-10	0.0808	V-10	0.0642	F-27-32	0.1096	3.0466	LA-10	0.5907	LE-10	0.0995	R-10	0.0435
0.3275         LH-19         0.0767         V-12         0.0415         Position         Vert. Defi_LA-12         0.5492         LE-12         0.0311         R-12           0.0311         Lat. Defi         V-14         0.0154         LWF-1         0.5492         LE-12         0.0311         R-12           0.1575         LH-12         V-14         0.0124         LWF-2         0.5093         LWF-2         0.5092           0.0359         LH-12         0.0143         V-15         0.0315         LWF-3         0.162         LWF-3         0.162           0.0359         LH-13         0.0143         V-16         0.0315         LWF-4         0.1492         LWF-4         0.1492           0.0516         F&ADeff.         F-26         0.0914         F-27         0.0914         F-27         0.0914           0.0207         LH-16         0.0435         LH-16         0.0435         F-27         0.0756         F-27         0.0756           0.0095         LH-18         0.0705         LH-18         0.0705         F-27         0.0905	LW-11	0.2342	LH-11	0.0767	V-11	0.0104		Wing	-	LA-11	0.2839	LE-11	0.0228	R-11	0.0788
0.0311         Lat. Defl. v-13         0.0508         Position + Up           0.1575         +Up         v-14         0.0124         LWF-1         0.2073           0.0332         LH-12         0.0199         V-15         0.0301         LWF-2         0.2092           0.0539         LH-13         0.0174         V-16         0.0425         LWF-3         0.1762           0.0516         H-20         0.0174         F-26         0.0945         LWF-4         0.1492           0.0516         +Aft         F-26         0.0914         LWF-4         0.1492           - LH-14         0.0166         F-27         0.0914         LWF-4         0.1492           - LH-15         0.0290         F-27         0.1076         D.1076           - Aft         LH-16         0.0435         F-27         0.1076           0.0151         LH-18         0.0705         D.0056	LW-12	0.3275		0.0767	V-12	0.0415			Vert. Defl	LA-12	0.5492	LE-12	0.0311	R-12	0.0642
0.1575         + Up         V-14         0.0124         LWF-1           0.2332         LH-12         0.0199         V-15         0.0301         LWF-2           0.0539         LH-13         0.0143         V-16         0.0425         LWF-3           0.0538         LH-20         0.0174         F & ADeff.         F-25         0.0794         LWF-4           0.0518         LH-14         0.0166         F-27         0.0914         LWF-4           0.0507         LH-14         0.0166         F-27         0.1076         LWF-4           -         LH-16         0.0435         F-27         0.1076         F-27           0.0151         LH-18         0.0705         B-27         0.1076         B-27           0.0095         LH-18         0.0705         B-27         0.1076         B-27	LW-13	0.0311		Lat. Defl.	V-13	0.0208		Position	4 Lp						
0.2332         LH-12         0.0199         V-15         0.0301         LWF-2           0.0539         LH-13         0.0143         V-16         0.0425         LWF-3           0.0533         LH-20         0.0174         F&ADeff.         F-25         0.0516         LWF-4           0.0518         F&ADeff.         F-26         0.0914         LWF-4         LWF-4           0.053         LH-14         0.0166         F-27         0.1076         LWF-4           -         LH-15         0.0435         F-27         0.1076         F-27           -         LH-16         0.0435         F-27         0.1076         F-27           0.0131         0.0705         F-27         0.1076         F-27	LW-14	0.1575		+ Up	V-14	0.0124		LWF-1	0.2073						
0.0539 LH-13 0.0143 V-16 0.0425 LWF-3 0.1347 LH-20 0.0174 V-17 0.0518 0.0518 F&ADEff. F-25 0.0794 0.0518	LW-15	0.2332	LH-12	0.0199	V-15	0.0301		LWF-2	0.2902						
0.0553 LH-20 0.0174 V-17 0.0518 LWF-4 0.0518 +Aft LH-14 0.0506 0.0207 LH-14 0.0166 F-27 0.1076 - LH-15 0.0435 F&A Defl. LH-17 0.0570 +Aft LH-18 0.0705 0.0095	LW-16	0.0539	LH-13	0.0143	N-16	0.0425		LWF-3	0.1762						
0.0953 F & A Defil. F - 25 0.0518 F & A Defil. F - 26 0.0933 LH - 14 0.0166 F - 27 0.0207 LH - 15 0.0290 F - 27 LH - 15 0.0435 F & A Defil. LH - 15 0.0435 F & A Defil. LH - 17 0.0570 + A ff LH - 18 0.0705 0.0095 0.0095	LW-17	0.1347	LH-20	0.0174	V-17	0.0518		LWF-4	0.1492						
0.095 0.0095 E&A Defl. LH-15 0.0095 0.0095 1.H-15 0.0151 0.0095 1.H-16 0.0150 1.H-16 0.0150 0.0095 0.0095	LW-18	0.0953		F & A Defl.	F-25	0.0794									
0.0207 LH-14 0.0166 LH-15 0.0290 LH-16 0.0435 F&A Defl. LH-17 0.0570 +Aft LH-18 0.0705 0.0095 0.0095	LW-20	0.0933		+ Aft	F-37	100.0									
LH-15 LH-16 F&A Defl. LH-17 + Aft LH-18 0.0055 0.0064	LW-21	0.0207	LH-14	0.0166		0.00									
- LH-16 F&A Defl. LH-17 + Aft LH-18 0.0151 0.0095	LW-22		LH-13	0.0290											
F& A Defl. LH-17 + Aff LH-18 0.0151 0.0095	LW-23	-	LH-16	0.0435											
0.0151		F & A Defl.	LH-17	0.0570											
		100	01	20.0.0											
	LW-24	0.0151													
	LW-25	0.0095													
		0.0064													

· Left Wing Down

#### ANTISYMMETRIC MODE SHAPE MODE 5 f = 23.0 cps g = 0.019

	Wing	Hori	Horiz. Stab.		Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Ru	Rudder
	>		Vert. Defl.		Lat. Defl.		Lat. Defl.	Lat. Defl. Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Defl.
Position	+ Cp	Position	+ Cp	Position	+ Left	Position	+ Left	X103.	Position	+ Cp	Position	4 Cp	Position	+ Left
LW-1	0.4138	LH-1	0.6034	V-1	0.0665	F-11-12	0.2241	3.0764	LA-1	0.6256	LE-1	0.7241	R-1	0 2414
LW-2	0.4828	LH-2	0.7167	V-2	0.0788	F-13-14	0.0665	6. 2483	LA-2	1.0000	LE-2	0.6700	2-2	0.2414
LW-3	0.5222	LH-3	0.4557	V-3	0.1576	F-15-16	0.0596	3.9847	LA-3	0.5788	LE-3	0.6305	8-3	0 1182
T.1.7	0.2833	TH-T	0.5320	1-1	0.0123	F-17-18	0.0877	3.3768	LA-4	0.9542	LE-4	0.5764	7-	1189
LW-5	0.3768	LH-5	0.3261	V-5	0.0788	F-19-20	0.0483	2.6424	LA-5	0.5320	F-5	0 4631		2010
9-M7	0.4557	9-H7	0.3695	9-A	0.0493	F-21-22	0.0296	1,7734	LA-6	0.9089	1.F-6	0 4039	9-0	0.00
LW-7	0.1601	LH-7	0.1523	V-7	0.0049	F-23-24	0.1300	0.2138	1.4-7	0.4695	1.5-7	0 3153	2-4	0.0346
LW-8	0.2808	S-H-	0.2084	8-7	0.1232	F-25-30	0.2222	1.7631	LA-8	0.7709	1.E-8	0 2364	9-8	0.00
6-M7	0.3926	LH-9	0.2315	0-V	0.0985	F-26-31	0.2611	3.1527	LA-9	0.4286	LE-9	0.1330	8-8	0.0985
LW-10	0.0394	LH-10	0.0813	V-10	0.1970	F-27-32	0.2675	4.5872	LA-10	0.7325	LE-10	0.0172	R-10	0.0985
LW-111	0.1897	LH-11	0.1123	٧-11	0.2069		Wing	Wing Fan	LA-11	0.4015	LE-11	0.0345	R-11	0.1675
LW-12	0.3300	LH-19	0.1034	V-12	0.3005			Vert. Defl	LA-12	0.7079	LE-12	0.1084	R-12	0.1675
LW-13	0.0640		Lat. Defl.	V-13	0.3547		Position	+ Up						
LW-14	0.1084		+ Left	V-14	0.0123		LWF-1	0.1527						
LW-15	0.2685	1 H-13	9561 0	V-15	0.0542		LWF-2	0.2512						
LW-16	0.1256		0210	V-16	0.1305		LWF-3	0 0576						
LW-17	0.2044	200	20.00	V-17	0.2118		LWF-4	0.0552						
LW-18	0.1232	Tu-so	0.0440	F-25	0.2222			-						
LW-19	0.1429		F & A Defl.	F-26	0.2601									
LW-20	0.0936		+ Aft	F-27	0.2640									
LW-21	0.0887	LH-14	0.0690											
LW-22	•	LH-15	0.1246											
LW-23	•	LH-16	0.1803											
_	F & A Doft	- LH-17	0. 2360											
	+ Aft	LH-18	0.2916											
LW-24	0.2739	_												
LW-25	0.2182													
LW-26	0.1635	1												
LW-27	0.0990													

· Left Wing Down

#### ANTISYMMETRIC MODE SHAPE MODE 6 f = 25.3 cps g = 0.046

Vert. Defl.		Vert. Defl.		Lat. Defl.		Lat. Defl. Ang. Defl.	Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Defl.
	Position	+ Up	Position	+ Left	Position	+ Left	X103.	Position	+ Cp	Position	d'U +	Position	+ Left
Г	LH-1	0.4248	V-1	0.0619	F-11-12	0.0685	6. 9942	LA-1	0.5591	LE-1	0.5310	R-1	0.1540
	LH-2	0.4903	V-2	0.0602	F-13-14	0.0159	3, 4280	LA-2	1.0000	LE-2	0.5133	R-2	0.1027
	LH-3	0.3133	V-3	0.0841	F-15-16	0.0301	2, 2271	L.A-3	0. 1956	LE-3	0.4513	R-3	0.0735
	LH-4	0.3575	V-4	0.0363	F-17-18	0.0441	2.0018	LA-4	0.9575	1.E-4	0.4336	R-4	0.0310
	LH-5	0.2088	V-5	0.0478	F-19-20	0.0354	1.7342	LA-5	0.4398	LE-5	0.3186	R-5	0.0071
	1 H-6	0.2425	9-A	0.0071	F-21-22	0.0000	I. 2389	LA-6	0.9230	LE-6	0.3080	R-6	0.0230
	LH-7	0.1026	V-7	0.0088	F-23-24	0.0379	6.4779	LA-7	0.3761	LE-7	0.2195	R-7	0.0230
	LH-8	0.1124	V-8	0.0319	F-25-30	6.1177	0.3540	I.A-8	0.7292	LE-8	0.2088	8-8	0.0487
	LH-9	0.1389	6-A	0.0327	F-26-31	0.1416	1.0619	LA-9	0.3363	LE-9	0.0973	R-9	0.0761
	LH-10	0.0336	V-10	0.0796	F-27-32	0.1480	1.9802	LA-10	0.7027	LE-10	0.0938	R-10	0.0920
	LH-111	0.0384	V-11	0.0814		Wing Fan	Fan	LA-11	0.3097	LE-11	0.0310	R-11	0.1257
	LH-19	0.0354	V-12	0.1212			Vert. Deff. LA-12	LA-12	0.6876	LE-12	0.0265	R-12	0.1310
		Lat. Defl.	V-13	0.1558		Position	+ Up						
		. + Left	V-14	0.0319		LWF-1	0.2124						
	LH-12	0.1770	V-15	0.0000		LWF-2	0.3115						
	LH-13	0.1274	V-16	0.0354		LWF-3	0.0814						
	LH-20	0.1522	V-17	0.0814		LWF-4	0,1257						
		F& A Deft.		0.1177									
		+ Aft		0.1414									
	LH-14	0.0381	F-27	0.1465									
	LH-15	0.0690											
	LH-16	0.0998											
	LH-17	0.1306											
F & A Defl.	_	0.1614											
0,0857	_												
0.0683													
0.0512													

### ANTISYMMETRIC MODE SHAPE MODE 7 f = 34.8 cps g = 0.040

	Wing	Howin	400	1			1.10				i			
	Vort Doff	11011	Tome Doel	110		S. T.	ruselage (N.L. 100)	1001	F.	Alleron	Fie	Lievator	킾	Kudder
			vert. Den.		Lat. Dell.	Ņ	Lat. Deff.	Lat. Deti. Ang. Deti.		Vert. Dell.		Vert. Defl.		Lat. Defi.
Position	d.) +	Position	+ Up	Position	+ Left	Position	+ Left	$_{ m X10^{3*}}$	Position	d:) +	Position	d:) +	Position	+ Left
LW-1	0.6408	LH-1	0.0563	V-1	0.0352	F-11-12	0.0317	8.1690	LA-1	0.4648	LE-1	0.0423	R-1	0.0845
LW-2	0.5915	LH-2	0.0423	V-2	0.0282	F-13-14	0.0000	5.4930	LA-2	0.5930	LE-2	0.0592	R-2	0.0704
LW-3	0.5676	LH-3	0.0338	7-3	0.0282	F-15-16	0.0352	2.0422	LA-3	0.2676	LE-3	0.0296	R-3	0.0423
LW-4	0.5535	LH-4	0.0225	f-1	0.0352	F-17-18	0.1028	0.2817	LA-4	0.7310	LE-4	0.0465	R-4	0.0169
LW-5	0.4563	LH-5	0.0153	V-5	0.0282	F-19-20	0.0056	1.1690	LA-5	0.0831	LE-5	0.0127	R-5	0.0190
LW-6	0.3268	1.H-6	0.0127	9-1	0.0310	F-21-22	0.0190	1.4789	L.A-6	0.5648	LE-6	0.0296	R-6	0.0085
LW-7	0.4746	LH-7	0.0423	7-7	0.0239	F-23-24	0.0120	1.1268	L.A-7	0.1408	LE-7	0.0042	R-7	0.0169
LW-8	0.3380	LH-8	0.0113	V-8	0.0254	F-25-30	0.0084	0.7746	LA-8	0.7930	LE-8	0.0183	R-6	0.0141
LW-9	0.1296	LH-9	0.0056	6-1	0.0085	F-26-31	0.0169	0.3662	L.A-9	0.2282	LE-9	0.0028	R-9	0.0141
LW-10	0.4028	LH-10	0.0225	V-10	0.0211	F-27-32	0.0197	0.2535	LA-10	0.9268	LE-10	0.0056	R-10	0.0239
LW-11	0.2324	LH-11	0.0028	V-11	0.0197				LA-11	0.2676	LE-11	0.0014	R-11	0.0113
LW-12	0.0239	LH-19	0.0056	V-12	0.0535		W I III	Wing Fill	LA-12	1.0000	LE-12	0.0014	R-12	$\bar{0}$ , 0282
LW-15	0.3296		I a' Doff	V-13	0.0352		Docition	+ ['0		7			_	
LW-14	0.1577		+ Left	V-14	0.0254		rosinon	3						
LW-15	0.1268	1 H-13	0.470	V-15	0.0225		LWF-1	0.1408						
LW-16	0.2479	1.H-13	0.0310	V-16	0.0127		LWF-2	0.2817						
LW-17	0.1958	1.H-20	0.0010	V-17	0.0042		LWF-3	0.0034						
LW-18	0.1746		E f. A Doft	F-25	0.0084	_	- *- 1 * 1	0.1408						
LW-19	0.2056		+ Aft	F-26	0.0170									
LW-20	0.1127	1 H-12	0.0063	F-27	0.0196									
LW-21	0.1620	1.H-15	0.0000											
LW-22	ı	1.H-16	0.0165											
LW-23	1	7.H-17	0.0217											
	F& A Defl.		0.0268											
	+ Aft													
LW-24	0.0944													
LW-25	0.0752													
LW-26	0.0562													
LW-27	0.0341	_												
* Left v	* Left Wing Down													

# ANTISYMMETRIC MODE SHAPE MODE 8 f = 36.8 cps g = 0.058

Nort. Define	Wing		Horiz.	Horiz. Stab.	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ai	Aileron	Ele	Elevator	R	Rudder
0.4602         LH-1         0.0722         V-1         0.0266         F-11-12         0.0030         3.9549           0.4211         LH-2         0.1496         V-2         0.0236         F-11-12         0.0075         2.5865           0.3489         LH-3         0.0481         V-3         0.0234         F-15-16         0.0038         1.436           0.3263         LH-3         0.0481         V-4         0.0203         F-17-18         0.0153         1.436           0.3263         LH-6         0.0286         V-5         0.0201         F-17-18         0.0153         1.436           0.4015         LH-7         0.0180         V-6         0.0021         F-21-22         0.0153         1.436           0.4015         LH-9         0.0286         V-6         0.0031         F-21-22         0.0153         1.456           0.156         LH-19         0.0492         V-9         0.0031         F-21-22         0.0155         0.4511           0.156         LH-10         0.0492         V-9         0.0031         F-21-22         0.0155         0.4511           0.157         LH-10         0.0241         V-10         0.0031         F-21-22         0.0155 <td< th=""><th></th><th>1000</th><th></th><th>-</th><th>Position</th><th>Lat. Defl. + Left</th><th>Position</th><th>Lat. Defl.</th><th>Ang. Defl.</th><th>Position</th><th>Vert. Defl.</th><th>Doction</th><th>Vert. Defl.</th><th></th><th>Lat. Defl.</th></td<>		1000		-	Position	Lat. Defl. + Left	Position	Lat. Defl.	Ang. Defl.	Position	Vert. Defl.	Doction	Vert. Defl.		Lat. Defl.
0.4211         LH-2         0.1496         V-2         0.0234         F-13-14         0.0053         1.436           0.3489         LH-3         0.0481         V-3         0.0244         F-15-16         0.0038         1.436           0.4421         LH-4         0.01119         V-4         0.0234         F-15-16         0.0038         1.436           0.2241         LH-5         0.0286         V-5         0.0211         F-19-20         0.0132         1.436           0.4015         LH-7         0.0180         V-7         0.0117         F-12-21         0.0132         0.0234         0.0111         0.0234         0.0111         0.0234         0.0111         0	-	-	.H-1	0.0722	V-1	0.0266	F-11-12	0.0030	3.9549	LA-1		LE-1	0.1624		0.0301
0.3489         LH-3         0.0481         V-3         0.0244         F-15-16         0.038         1.1436           0.3263         LH-4         0.1119         V-4         0.0203         F-17-18         0.0133         1.0266           0.3263         LH-5         0.0286         V-5         0.0203         F-17-18         0.0133         1.0266           0.4015         LH-6         0.0785         V-6         0.0031         F-21-22         0.0193         0.4511           0.4015         LH-7         0.0120         V-8         0.0049         F-23-24         0.0111         0.4211           0.1158         LH-10         0.0271         V-9         0.0035         F-26-31         0.0090         0.4060           0.1158         LH-11         0.0241         V-10         0.0033         F-26-31         0.0090         0.4060           0.0276         LH-19         0.0214         V-11         0.0103         F-26-31         0.0091         0.4160           0.0276         LH-19         0.0214         V-12         0.0233         F-27-32         0.0218         LWF-1         0.0128           0.0276         LH-19         0.0707         V-15         0.0023         LWF-2	-		.H-2	0.1496	V-2	0.0239	F-13-14	0.0073	2000	I.A-2	0.7669	1 5-2	1609	0	
0.4421         LH-4         0.1119         V-4         0.0203         F-17-18         0.0153         1.7450           0.3263         LH-5         0.0256         V-5         0.0211         F-19-20         0.0153         1.0226           0.2241         LH-6         0.0755         V-6         0.0211         F-19-20         0.0155         0.0151           0.4015         LH-7         0.0120         V-7         0.0147         F-23-24         0.0111         0.4211           0.1158         LH-9         0.0120         V-8         0.0095         F-25-30         0.0010         0.4060           0.0156         LH-10         0.0241         V-11         0.0132         F-27-32         0.0111         0.4160           0.0276         LH-10         0.0241         V-11         0.0133         F-27-32         0.0118         0.416           0.0276         LH-11         0.0241         V-11         0.0233         F-27-32         0.018         0.018           0.0466         LH-13         0.0556         V-15         0.0233         LWF-1         0.018           0.1056         LH-13         0.0556         V-16         0.0060         LWF-3         0.0188 <t< td=""><td></td><td></td><td>.H-3</td><td>0.0481</td><td>V-3</td><td>0.0244</td><td>F-15-16</td><td>0.0038</td><td>2000</td><td>I.A.3</td><td>0 1504</td><td>1 2 2</td><td>0.100</td><td>7 6</td><td>0.000</td></t<>			.H-3	0.0481	V-3	0.0244	F-15-16	0.0038	2000	I.A.3	0 1504	1 2 2	0.100	7 6	0.000
0.3263         LH-5         0.0286         V-5         0.011         F-19-20         0.0234         0.0250           0.2241         LH-6         0.0785         V-6         0.0081         F-21-22         0.0195         0.0451           0.4015         LH-7         0.0180         V-7         0.0081         F-21-22         0.0195         0.4511           0.2481         LH-8         0.0120         V-8         0.0095         F-25-30         0.0195         0.4511           0.1156         LH-9         0.0492         V-9         0.0095         F-25-30         0.0195         0.3759           0.1156         LH-10         0.0492         V-9         0.0033         F-27-32         0.0116         0.3759           0.0278         LH-10         0.0241         V-10         0.0033         F-27-32         0.0218         0.3759           0.0276         LH-11         0.0241         V-11         0.0033         F-27-32         0.0218         0.0378           0.0406         LH-12         0.0147         V-15         0.0060         LWF-1         0.0031           0.128         LH-13         0.0586         V-16         0.0060         LWF-2         0.1068           <	_		H-4	0.1119	V-1	0.0203	F-17-18	0.0033	1.4436	7 4 7	10010		0.1429	2-2	0.0030
0.2241 LH-6 0.0765 V-6 0.0081 F-21-22 0.0195 0.4511 0.0415 0.0765 V-6 0.0081 F-22-24 0.0111 0.4211 0.0241 LH-9 0.0492 V-9 0.0095 F-25-30 0.0000 0.4060 0.03459 0.035 F-25-30 0.0000 0.4060 0.0492 V-9 0.0331 F-27-32 0.0111 0.4211 0.0241 V-11 0.0241 V-11 0.023			E .	9360 0	V-5	0000	00 00	0.0103	1.0226		0.0401	1 1	0.1368	K-4	0.0015
0.0241         LH-10         0.0180         V-7         0.0051         F-21-22         0.0195         0.4511           0.2461         LH-7         0.0180         V-7         0.0147         F-23-24         0.0109         0.4511           0.1156         LH-9         0.0492         V-9         0.0095         F-25-30         0.0000         0.4060           0.1156         LH-9         0.0492         V-9         0.0033         F-26-31         0.0099         0.4060           0.0271         V-10         0.0105         V-11         0.0105         V-12         0.0234           0.0276         LH-19         0.0241         V-11         0.0105         V-12         0.0233           0.0276         LH-19         0.015         V-14         0.0105         V-14         0.0105           0.0406         LH-12         0.0707         V-15         0.0060         LWF-1         0.008           0.0992         LH-13         0.0562         V-17         0.0263         LWF-2         0.108           0.1128         LH-14         0.0074         F-26         0.0099         LWF-3         0.0128           0.0996         LH-14         0.0074         F-27         0.0231 <td></td> <td></td> <td></td> <td>000</td> <td></td> <td>0.0211</td> <td>07-61-1</td> <td>0.0234</td> <td>0.6015</td> <td>LA-5</td> <td>0.0586</td> <td>LE-5</td> <td>0.1068</td> <td>R-5</td> <td>0.0150</td>				000		0.0211	07-61-1	0.0234	0.6015	LA-5	0.0586	LE-5	0.1068	R-5	0.0150
0.4015         LH-7         0.0180         V-7         0.0147         F-23-24         0.0111         0.4211           0.2481         LH-6         0.0120         V-8         0.0095         F-25-30         0.0000         0.4060           0.1158         LH-9         0.0492         V-9         0.0038         F-25-30         0.0000         0.4060           0.1459         LH-10         0.0241         V-10         0.0031         F-27-32         0.0209         0.3759           0.1555         LH-11         0.0241         V-11         0.0105         V-12         0.0051         V-14         0.0105           0.1534         LH-12         0.015         V-14         0.0061         LWF-1         0.0371           0.1910         LH-12         0.056         V-16         0.0060         LWF-2         0.1008           0.1920         LH-13         0.056         V-16         0.0060         LWF-2         0.1008           0.1930         LH-13         0.0662         V-17         0.0263         LWF-3         0.1128           0.1158         LH-14         0.0074         F-26         0.0263         LWF-4         0.0526           -         LH-15         0.0132			9-H-	0.0785	9-1	0.0081	F-21-22	0.0195	0.4511	FA-6	0.9233	LE-6	0.0977	R-6	0.0134
0.2481 LH-6 0.0120 V-8 0.0095 F-25-30 0.0000 0.4060 0.1158 LH-9 0.0492 V-9 0.0038 F-26-31 0.0099 0.3759 0.3459 LH-10 0.0241 V-11 0.0331 F-27-32 0.0299 0.3759 0.1955 LH-11 0.0241 V-11 0.0033	_		-H-7	0.0180	V-7	0.0147	F-23-24	0.0111	0.4211	LA-7	0.0526	LE-7	0.0782	R-7	0.0211
0.1156         LH-9         0.0492         V-9         0.0038         F-26-31         0.0999         0.3759           0.3459         LH-10         0.0241         V-10         0.0331         F-27-32         0.0218         0.3759           0.0278         LH-11         0.0241         V-11         0.0105         Wing Fan         Ving Fan           0.0278         LH-19         0.0241         V-12         0.0233         V-12         0.0153           0.2767         LH-19         0.015         V-12         0.0233         V-12         0.0511           0.1534         LH-12         0.0707         V-15         0.0060         LWF-2         0.1088           0.1940         LH-13         0.0562         V-16         0.0060         LWF-2         0.1088           0.1128         LH-13         0.0662         V-17         0.0263         LWF-2         0.1088           0.1128         LH-14         0.0074         F-25         0.0293         LWF-4         0.0526           0.1158         LH-16         0.0132         -27         0.0221         LWF-4         0.0526           - LH-17         0.0251         -27         0.0221         -27         0.0221         0.0			8-H-	0.0120	8-7	0.0095	F-25-30	0.0000	0.4060	LA-8	0.8662	LE-8	0.0677	8-8	0.0195
0.3459         LH-10         0.0271         V-10         0.0331         F-27-32         \$\text{0.0218}\$         \$\text{0.3759}\$           0.1955         LH-11         0.0241         V-11         0.0105         Wing Fan         Vert. Defl.           0.2767         LH-19         0.015         V-12         0.0233         Vert. Defl.         Vert. Defl.           0.2767         LH-12         0.015         V-13         0.0611         Vert. Defl.         Vert. Defl.           0.0406         LH-12         0.0707         V-15         0.0661         LWF-2         0.1088           0.0992         LH-13         0.0566         V-16         0.0060         LWF-2         0.1088           0.1248         LH-14         0.0662         V-17         0.0263         LWF-4         0.0526           0.1248         LH-14         0.0074         F-26         0.0099         LWF-4         0.0526           0.158         LH-16         0.0132         -27         0.0221         LWF-4         0.0526           - LH-17         0.0251         -27         0.0221         -27         0.0221           + Aft	_		6-H	0.0492	6-A	0.0038	F-26-31	0.0099	0.3759	LA-9	0.1278	LE-9	0.0376	R-9	0.0316
0.1955         LH-11         0.0241         V-11         0.0103         Wing Fan           0.276         LH-19         0.0015         V-12         0.0233         Wing Fan           0.2767         LH-19         0.0015         V-12         0.0233         Wing Fan           0.2767         LH-19         0.0051         V-14         0.0611         Pert. Defl.           0.0406         LH-12         0.0707         V-15         0.0060         LWF-2         0.1038           0.0992         LH-13         0.0562         V-17         0.0263         LWF-3         0.1128           0.1248         LH-14         0.0662         V-17         0.0263         LWF-4         0.0526           0.148         LH-15         0.0132         F-26         0.0099         LWF-4         0.0526           0.158         LH-16         0.0132         F-27         0.0221         LWF-4         0.0526           - LH-17         0.0251         F-27         0.0221         F-27         0.0221           + Aft         C-0502         C-0502         C-0502         C-0502         C-0502           0.0400         C-0502         C-0502         C-0502         C-0502         C-0502 </td <td>01</td> <td></td> <td></td> <td>0.0271</td> <td>V-10</td> <td>0.0331</td> <td>F-27-32</td> <td>0.0218</td> <td>0.3759</td> <td>LA-10</td> <td>0.9459</td> <td>LE-10</td> <td>0.0286</td> <td>R-10</td> <td>0.0286</td>	01			0.0271	V-10	0.0331	F-27-32	0.0218	0.3759	LA-10	0.9459	LE-10	0.0286	R-10	0.0286
0.0276         LH-19         0.0015         V-12         0.0233         Vert. Defl.           0.2767         Lat. Defl.         V-13         0.0611         Position         + Up           0.1534         LH-12         0.0707         V-14         0.0611         LWF-1         0.0331           0.0406         LH-12         0.0707         V-15         0.0060         LWF-2         0.1088           0.0992         LH-13         0.056         V-17         0.0263         LWF-3         0.1128           0.1248         + Aft         F-25         0.0999         LWF-4         0.0526           0.158         LH-14         0.0074         F-27         0.0221         LWF-4         0.0526           0.158         LH-16         0.0132         F-27         0.0221         LWF-4         0.0526           F&A Defl.         LH-18         0.0311         F-27         0.0221         C.0221         C.0221           0.0400         0.0299         D.0251         D.0221         D.0221         D.0221         D.0221				0.0241	V-11	0.0103		Wing	Fan	LA-11	0.1729	LE-11	0.0150	R-11	0.0361
0.2767         Lat. Defl. v-13         v-13         0.0611         Position + Up           0.1534         LH-12         0.0707         v-14         0.0195         LWF-1         0.0331           0.0406         LH-12         0.0707         v-15         0.0090         LWF-2         0.1008           0.0992         LH-13         0.0662         v-17         0.0263         LWF-2         0.1128           0.1248         LH-14         0.0074         F-26         0.0099         LWF-3         0.0128           0.1158         LH-14         0.0074         F-27         0.0221         LWF-4         0.0526           -         LH-16         0.0132         F-27         0.0221         LWF-4         0.0526           -         LH-17         0.0251         F-27         0.0221         LWF-4         0.0526           -         LH-18         0.0311         F-27         0.0221         F-24         0.0526           0.0400         0.0299         C-1158         C-1158         C-1158         C-1158         C-1158	-			0.0015	V-12	0.0233			1	LA-12	1 0000	1 5-10	0900		
0.1534         + Left         v-14         0.0195         LVF-1           0.0406         LH-12         0.0707         v-15         0.0090         LWF-2           0.0992         LH-0         0.0662         v-17         0.0263         LWF-3           0.0992         LH-18         0.0662         v-17         0.0263         LWF-4           0.1248         + Aft         F-26         0.0099         LWF-4           0.1158         LH-14         0.0074         F-27         0.0221           - LH-16         0.0132         - 27         0.0221           - LH-17         0.0251         - 27         0.0221           F&A Defi.         LH-18         0.0311           + Aft         0.0502         0.0400           0.0299         0.0182	-			Lat. Defl.	V-13	0.0611			vert. Dell.	:	0000:-	71-27	0.000	K-12	0.0331
0.0406 LH-12 0.0707 V-15 0.0990 LWF-2 0.0992 LH-20 0.0566 V-16 0.0060 0.1248	_	34		+ Left	V-14	0.0195		Position	4						
0.1910         LH-13         0.0586         V-16         0.0060         LWF-2           0.0992         LH-20         0.0662         V-17         0.0263         LWF-3           0.128         + Aft         F-25         0         LWF-4           0.1248         - Aft         F-26         0.0999         LWF-4           0.0496         LH-14         0.0074         F-27         0.0221         LWF-4           0.1158         LH-16         0.0132         -         LH-16         0.0251         -           F& Aft         - Aft         - Aft         -         -         -         -           0.0502         - O.0299         - O.0299         -         -         -         -			H-12	0.0707	V-15	0.0000		LWF-I	0.0331						
0.0992 LH-20 0.0662 V-17 0.0263 LWF-3 0.128	_		H-13	0.0586	V-16	0.0060		LWF-2	0.1008						
0.1128       F&A Defl.       F-25       0         0.1248       + Aft       F-26       0.099         0.0496       LH-14       0.0074       F-27       0.0221         0.1158       LH-15       0.0132       -       LH-16       0.0192         -       LH-17       0.0251       -       -       -         F&A Defl.       LH-18       0.0311       -       -         0.0502       0.0400       0.0299         0.0182       -       -	-			0.0662	V-17	0.0263		LWF-3	0.1128						
0.1248		28	11-	& A Deft.	F-25	0		LWI-4	0.0526						
0.0496 LH-14 0.0074 F-27 0.1158 LH-15 0.0132 - LH-16 0.0192 - LH-17 0.0251 F&A Defl. LH-18 0.0311 + Aft 0.0502 0.0400 0.0299 0.0182		48			F-26	0.0099									
0.1158 LH-15 - LH-16 - LH-17 F & A Defl. LH-18 + Aff 0.0502 0.0400 0.0299	-		H-14	Т	F-27	0.0221									
- LH-16 - LH-17 F & A Defl. LH-18 + Aft 0.0502 0.0400 0.0299			H-15	0.0132											
- LH-17 F&A Defl. LH-18 + Aft 0.0502 0.0400 0.0299	-22	-	H-16	0.0192											
F & A Defl. LH-18 + Aft 0.0502 0.0400 0.0299 0.0182	-23	-	Н-17	0.0251											
	FEA	_	H-18	0.0311											
	+ Afi														
	_	32													
	-	00													
-		66													
		32													

\* Left Wing Down

# ANTISYMMETRIC MODE SHAPE

f = 44.6 cps g = 0.063MODE 9

LPG1.         Position         + Lp         Position         Position         + Lp         Posi		Wing	Horiz	Horiz. Stab. **	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Ru	Rudder
- Up         Position         + Up         Position         + Left         Position         + Left         Noisiton         + Up         Position         +		Vert Defl.	L	Vert. Defl.		Lat. Defl.		Lat. Defl.	Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Defl.
0.0796         LH-1         0.0133         V-1         0.0132         V-2         0.0131         F-11-12         0.0246         1.0-1         0.0401         LE-1         0.0401         LE-1         0.0401         LE-1         0.0401         LE-2         0.0411         LE-2         0.0411         LE-2         0.0401         LE-2         0.0411         LE-2         0.0411         LE-2         0.0411         LE-2         0.0411         LE-3	Position	+ Up	Position	C.b	Position		Position	+ Left	X103*	Position	+ Up	Position	4 Up	Position	+ Left
0.1099   LH-2   0.0102   V-2   0.0151   F-13-14   0.0041   2.3129   LA-2   1.0000   LE-2   0.0141     0.1099   LH-3   0.0109   V-3   0.0151   F-13-16   0.0269   0.6603   LA-3   0.1020   LE-3   0.0041     0.1099   LH-4   0.0095   V-3   0.0152   F-13-20   0.0069   0.6603   LA-3   0.1020   LE-3   0.0004     0.1514   LH-6   0.0096   V-6   0.0173   F-13-20   0.0041   0.4762   LA-5   0.1401   LE-5   0.0060     0.1529   LH-6   0.0066   V-8   0.0174   F-22-20   0.0041   0.4762   LA-7   0.1633   LE-6   0.0067     0.1529   LH-1   0.0065   V-9   0.0113   F-23-20   0.0069   0.4422   LA-7   0.1633   LE-6   0.0106     0.1529   LH-1   0.0065   V-1   0.0114   F-23-20   0.0061   V-1   0.0145     0.1529   LH-1   0.0065   V-1   0.0114   F-23-20   0.0061   V-1	I.W-1		LH-1	0.0135	V-1	0.0152.	F-11-12	0.0286	4.0136	LA-1	0.0401	LE-1	0.0004	R-1	0.0110
Colored   Colo	LW-2	0800	LH-2	0.0122	V-2	0.0151	F-13-14	0.0041	2.3129	LA-2	1.0000	LE-2	0.0141	8-2	0.0116
Colored   Colo	I.W-3	0.1099	LH-3	0.0109	V-3	0.0161	F-15-16	0.0109	1.0204	LA-3	0.1020	LE-3	0.0073	R-3	0.0224
10   10   10   10   10   10   10   10	1.W-4	0.1619	7-H-7	0.0097	V-4	0.0173	F-17-18	0.0269	0.6803	LA-4	0.8844	LE-4	0.0080	7.	0.0238
Color   Colo	I W.S	0.0680	LH-5	0.0088	V-5	0.0152	F-19-20	0.0086	0.4762	LA-5	0.1401	LE-5	0.0118	R-5	0.0279
Course   C	1.W-6	0.1544	9-H-1	0.0080	9-A	0.0174	F-21-22	0.0041	0.4762	FA-6	0.8503	FE-6	0.0067	R-6	0.0291
0.0299         LH-6         0.0076         V-8         0.0152         F-25-30         0.0069         0.4422         LA-9         0.5510         LE-8         0.0077           0.1823         LH-9         0.0068         V-9         0.0111         F-25-31         0.017         LA-9         0.1721         LE-9         0.0075           0.2299         LH-10         0.0061         V-11         0.0078         V-13         0.0049         V-11         0.0175         LA-10         0.1860         LE-10         0.0056         LE-11         0.0056         LE-12	LW-7	0.2102	LH-7	0.0126	V-7	0.0136	F-23-24	0.0105	0.4762	7-5	0.1653	LE-7	0.0110	R-7	0.0288
0.1823         LH-9         0.0068         V-9         0.0111         F-26-31         0.0017         0.3401         LA-9         0.1721         LE-9         0.0168           0.2299         LH-10         0.0126         V-10         0.0110         F-27-32         0.0177         0.0600         LA-10         0.0560         LE-10         0.0189           2 0.1352         LH-11         0.0064         V-12         0.0073         V-12         0.0054         LA-11         0.0560         LE-12         0.0560         LE-12         0.0064         LE-12         0.0560         LE-12         0.0660         LE-12         0.0660         LE-12         0.0164         LE-12         0.0660         LE-12         0.0164         LE-12         0.0164         LE-12         0.0164         LE-12         0.0164         LE-12         0.0164	LW-8	0.0299	8-H7	0.0076	8-A	0.0152	F-25-30	0.0069	0.4422	LA-8	0.5510	LE-8	0.0107	<b>8-8</b>	0.0296
0.0299         LH-10         0.0126         V-10         0.0110         F-27-32         0.0177         0.0650         LE-10         0.0269           0.0156         LH-11         0.0061         V-12         0.0075         V-12         0.0177         0.0170         LA-11         0.0560         LE-12         0.0269           0.1852         LH-13         0.0061         V-12         0.0049         LWF-1         0.0354         LA-11         0.1735         LE-12         0.0061           0.0673         LH-13         0.0069         V-16         0.0094         LWF-3         0.0354         LWF-1         0.0054         LWF-1         0.0054         LWF-1         0.0054         LWF-1         0.0054         LWF-1         0.0054         LWF-1         0.0054         LWF-1         0.0164         LWF-1         0.0164         WF-1         0.0054         LWF-1         0.0164         WF-1         0.0164         WF-1         0.0164	LW-9	0.1823	CH-9	0.0068	6-A	0.0111	F-26-31	0.0017	0.3401	LA-9	0.1721	LE-9	0.0168	R-9	0.0272
0.0156         LH-11         0.0064         V-12         0.0075         Wing Fan         LA-11         0.1735         LE-11         0.0066           0.1952         LH-19         0.0066         V-12         0.0049         Vert. Defl.         LA-12         0.5850         LE-12         0.0066           0.2569         LH-19         0.0066         V-12         0.0049         LWF-1         0.0354         LA-12         0.5850         LE-12         0.0061           0.0673         LH-12         0.0133         V-15         0.0135         LWF-2         0.0354         LWF-3         0.0354         LWF-3         0.0069         LWF-4         0.0184         LWF-4         0.0184 <td>LW-10</td> <th>0.2299</th> <td>LH-10</td> <td>0.0126</td> <td>V-10</td> <td>0.0110</td> <td>F-27-32</td> <td>0.0177</td> <td>0.0680</td> <td>LA-10</td> <td>0.5660</td> <td>LE-10</td> <td>0.0129</td> <td>R-10</td> <td>0.0269</td>	LW-10	0.2299	LH-10	0.0126	V-10	0.0110	F-27-32	0.0177	0.0680	LA-10	0.5660	LE-10	0.0129	R-10	0.0269
0. 269         LH-19         0. 0066         V-12         0. 0049         Vert. Defl. LA-12         0. 5850         LE-12         0. 0061           0. 269         LH-12         V-13         0. 0054         LWF-1         0. 0354         LWF-1         0. 0354           0. 0673         LH-12         V-15         0. 0135         LWF-2         0. 0354         LWF-2         0. 0354           0. 1956         LH-13         0. 0000         V-16         0. 0033         LWF-3         0. 1007:           0. 1565         LH-14         0. 014         F-26         0. 0013         LWF-4         0. 0184           0. 1068         LH-14         0. 014         F-26         0. 0018         LWF-4         0. 0184           -         LH-16         0. 0129         F-27         0. 0176         RWF-4         0. 0184           -         LH-18         0. 0129         RWF-18         0. 0190         RWF-18         0. 0190           0. 0058         LWF-18         0. 0190         RWF-18         0. 0190         RWF-18         0. 0190	LW-11	0.0156	LH-11	0.0061	V-11	0.0078		Wing	Fan	LA-11	0.1735	LE-11	9600.0	R-11	0.0218
0.2269         Lat. Defl. v-13         v-13         0.0054         Position           0.05269         LH-12         0.0133         V-15         0.0154         LWF-1           0.052         LH-13         0.0003         V-16         0.0135         LWF-2           0.1565         LH-13         0.0005         V-17         0.0094         LWF-3           0.1565         LH-13         0.0075         V-17         0.0094         LWF-3           0.1565         LH-14         0.0075         V-17         0.0099         LWF-4           0.1068         LH-14         0.0143         F-27         0.0178         LWF-4           -         LH-16         0.0129         F-27         0.0178         LWF-4           -         LH-18         0.0129         F-27         0.0178         F-27           0.0256         0.0266         0.0189         F-27         0.0178         F-27	LW-12	0.1952	LH-19	0.0068	V-12	9.0049			Vert. Defl.	LA-12	0.5850	LE-12	0.0061	R-12	0.0199
0.0673         + Left         V-14         0.0154         LWF-1           0.1952         LH-12         0.0133         V-15         0.0135         LWF-2           0.1996         LH-13         0.0000         V-16         0.0094         LWF-3           0.1565         LH-20         0.0075         V-17         0.0099         LWF-4           0.1565         LH-14         0.0075         F-26         0.0018         LWF-4           0.1020         LH-14         0.0136         F-27         0.0178         LWF-4           -         LH-16         0.0129         F-27         0.0178         F-27         0.0178           -         LH-18         0.0190         F-27         0.0178         F-27         0.0178           -         LH-18         0.0190         F-27         0.0178         F-27         0.0178           -         LH-18         0.0190         F-27         0.0178         F-27         0.0178           0.0256         0.0256         F-27         0.0180         F-27         0.0180	LW-13	0.2269		Lat. Defl.	V-13	0.0084		Position	4 Up						
0. 1952         LH-12         0. 0133         V-15         0. 0135         LWF-2           0. 1996         LH-13         0. 0000         V-16         0. 0094         LWF-3           0. 1565         LH-20         0. 0075         V-17         0. 0003         LWF-4           0. 1563         LH-14         0. 0075         V-17         0. 0069         LWF-4           0. 1563         LH-14         0. 0143         F-26         0. 0018         LWF-4           0. 1122         LH-16         0. 0136         F-27         0. 0178         LWF-4           -         LH-16         0. 0129         F-27         0. 0178         F-27         0. 0178           -         LH-18         0. 0190         F-27         0. 0178         F-27         0. 0178           -         LH-18         0. 0190         F-27         0. 0178         F-27         0. 0178           -         LH-18         0. 0190         F-27         0. 0178         F-27         0. 0178           0. 0206         0. 0206         0. 0190         F-27         0. 0178         F-27         0. 0178	LW-14	0.0673		+ Left	V-14	0.0154		LWF-1	0.0354						
0. 1996       LH-13       0. 0000       V-16       0. 0094       LWF-3         0. 1565       LH-20       0. 0075       V-17       0. 0033       LWF-4         0. 1563       LH-14       0. 0075       F-26       0. 0069       LWF-4         0. 1068       LH-14       0. 0143       F-27       0. 0178       LWF-4         0. 1122       LH-15       0. 0136       F-27       0. 0178       LWF-4         -       LH-16       0. 0129       F-27       0. 0178         -       LH-18       0. 0190       F-27       0. 0178         -       LH-18       0. 0190       F-27       0. 0178         0. 0256       0. 0190       F-27       0. 0178	LW-15		LH-12	0.0133	V-15	0.0135		LWF-2	0.0292						
0. 1565         LH-20         0. 0075         V-17         0. 0033         LWF-4           0. 1565         LH-18         0. 0075         V-17         0. 0069         LWF-4           0. 1503         LH-14         F-26         0. 0018         C. 0018           0. 1022         LH-15         0. 0136         F-27         0. 0178           -         LH-16         0. 0129         C. 0. 018           -         LH-17         0. 0122         C. 0. 016           + Aft         RH-18         0. 0190           0. 0206         0. 0154           0. 0093         C. 0003	LW-16	_	LH-13	0.0000	V-16	0.0094		LWF-3	0.1007						
0. 1565 0. 1503 0. 1068 1. 122 0. 1068 1. 122 1. 123 1. 124-15 0. 0136 1. 124-15 0. 0129 1. 124-17 0. 0129 1. 124-18 0. 0126 0. 0206 0. 01054 0. 0093	LW-17	0.1796	LH-20	0.0075		0.0033		LWF-4	0.0184	_					
0.1503	LW-18	0.1565		F & A Defl.		0.0069									
0. 1068 LH-14 0.0143 F-27 0.1122 LH-15 0.0136	LW-19	_		+ Aft		0.0018									
0.1122 LH-15 - LH-16 - LH-17 - Aft RH-18 0.0258 0.0206 0.0154 0.0093	LW-20	-	LH-14	0.0143	F-27	0.0178									
- LH-16 - LH-17 F& A Defl. LH-18 - Aft RH-18 0.0258 0.0206 0.0154 0.0093	LW-21	0.1122	LH-15	0.0136											
F& A Defl. LH-18 + Aft RH-18 0.0258 0.0206 0.0154 0.0093	LW-22	1	LH-16	0.0129											
F & A Defl. LH-18 + Aft RH-18 0.0258 0.0206 0.0154 0.0093	LW-23	1	LH-17	0.0122	_										
+ Aft RH-18 0.01 0.0258 0.0206 0.0154 0.0093		F& A Defl.	_	0.0116											
		+ Aft	_												
	LW-24	_													
	LW-25	_													
_	LW-26														
	LW-27	_	_												

Left Wing Down
 Symmetric Response (essentially Elevator Bending with Response at higher frequency)

ANTISYMMETRIC MODE SHAPE

Mode 10 f = 50.6 cps g = 0.033

Net. Def.  Net. Def.  Net. Def.  Net. Def.  Net. Def.  Ag. Def.  Ag. Def.  Ag. Def.  Net. Def.  N	11	Wing	Horiz	Horiz. Stab.	Vert.	Vert. Stab.	Fu	Fuselage (W.L 100)	100)	AII	Aileron	Ele	Elevator	Ru	Rudder
+ Up         Position         Pub         Pub         Pub		Vert. Deft.				Lat. Defl.		Lat. Defl.	Ang. Defl.		Vert. Doft.		Vert. Defl.		Lat. Defl.
0.0496 LH-1 0.1199 V-1 0.1611 F-11-12 0.0211 I.497 LA-1 0.0218 LE-1 0.0817 R-1 0.0341 LH-2 0.0691 V-2 0.06918 F-13-14 0.0352 LH-4 0.0813 LH-3 0.1131 V-2 0.1131 F-13-14 0.0830 0.2730 LH-3 0.1131 F-13-14 0.0830 0.2730 LH-3 0.0132 LH-4 0.0813 V-4 0.1131 F-13-2 0.0132 LH-4 0.0813 V-4 0.1131 F-13-2 0.0131 LA-3 0.0132 LH-4 0.0813 V-4 0.1131 F-13-2 0.0131 LA-3 0.0132 LH-4 0.0813 LH-6 0.0831 LH-6 0.0831 V-4 0.1131 F-13-2 0.0831 LA-6 0.0831 LH-7 0.0836 V-7 0.1139 F-2-24 0.1139 I.4-4 0.0831 LH-9 0.0831 V-9 0.1139 F-2-24 0.1139 I.4-4 0.0831 LH-9 0.0831 V-9 0.1139 F-2-324 0.1139 I.4-4 0.0831 LH-9 0.0832 V-11 0.1139 F-2-24 0.1139 I.4-1 0.0034 LH-9 0.0832 V-11 0.1139 I.4-1 0.0034 LH-9 0.0832 V-11 0.1139 I.4-1 0.0034 LH-1 0.0832 V-11 0.1139 I.4-1 0.0034 LH-1 0.0832 V-11 0.1139 I.4-1 0.0034 I.4-1 0.003	Position	+ Up	Position	•	Position	+ Up	Position	+ Left	X103.	Position	+ Up	Position	+ Up	Position	+ Left
0.0341         LH-2         0.0697         V-2         0.0610         F-13-14         0.0050         0.2750         LA-2         0.0444         LE-2         0.0451         R-2         0.0451         LE-3         0.0451         LE-3         0.0451         R-3         0.0451         LE-3         0.0452         LE-4         0.0522         <	LW-1	9010.0	LH-1	0.1190	V-1	0.1611	F-11-12	0.0241	1. 4977	LA-1	0.0218	LE-1	0.0817	R-1	0.4717
0.0152	LW-2	0.0464	LH-2	0.0697	V-2	0.0610	F-13-14	0.0000	0.2730	LA-2	0.0464	LE-2	0.1023	R-2	0.4572
0.0312	LW-3	0.0381	LH-3	0.1154	V-3	0.1451	F-15-16	0.0061	0.5155	LA-3	0.0174	LE-3	0.0871	R-3	0.8926
0.0370         LH+5         0.1056         V-5         0.1451         F-19-20         0.0513         LA-6         0.0123         LE-5         0.0123         LE-5         0.0292         R-5           0.0351         LH-6         0.0354         V-8         0.1451         F-21-22         0.1248         LA-6         0.0351         LE-6         0.0161         R-6           0.0351         LH-8         0.0356         V-9         0.1454         F-21-22         0.1359         LA-7         0.0359         LE-7         0.0359         LP-7         0.0356         LP-9         0.0145         LA-8         0.0029         LE-8         0.0145         R-8         0.0459         LP-9         0.145         LA-10         0.0029         LE-9         0.0459         R-8         0.0459         LA-10         0.0359         LE-9         0.0459         LA-10         0.0359         LE-9         0.0459         LA-10         0.0359         LE-9         0.0459         LA-10         0.0459         LE-10         0.0459         LE-10         0.0459         LA-10         0.0459         LE-10         0.0459         LE-10         0.0459         LE-10         0.0459         LE-10         0.0459         LE-10         0.0459         LE-10	LW-4	0.0152	LH-4	0.0813	V-4	0.1582	F-17-18	0.0232	0.4139	1.4-4	0.0552	LE-4	0.1103	R-4	0.8708
0.0522         LH-6         0.0827         V-6         0.1634         F-21-22         0.1438         3.4833         LA-6         0.0631         LE-6         0.1161         R-6           0.0521         LH-7         0.0336         V-7         0.1536         F-22-34         0.1435         3.254         LA-7         0.038         LE-7         0.0356         R-7           0.0450         LH-9         0.0726         V-9         0.1496         F-22-34         0.1445         LE-8         0.0356         R-7           0.0450         LH-9         0.0726         V-10         0.1456         F-22-34         0.1456         LE-8         0.0356         R-9           0.0203         LH-10         0.0552         V-10         0.1858         F-27-32         0.1539         LE-9         0.0454         R-9           0.0216         LH-10         0.0552         V-11         0.0505         V-12         0.0559         V-14         0.0547         R-10         0.0547         R-10         0.0547         R-10         0.0547         R-10         0.0547         R-10         0.0548         R-10         0.0544         R-10         0.0548         R-10         0.0544         R-10         0.0448         R-10	LW-5	0.0370	LH-5	0.1016	V-5	0.1451	F-19-20	0.0813	2. 6392	LA-5	0.0123	LE-5	0.0929	R-5	1.0000
0.0283         LH-1         0.0936         V-7         0.1396         F-23-24         0.1379         3.5254         LA-7         0.0058         LE-7         0.0556         R-7           0.0283         LH-8         0.0132         V-9         0.1345         F-23-24         0.1349         LA-8         0.0756         LE-9         0.0556         R-7           0.0203         LH-10         0.0352         V-10         0.1559         F-27-32         0.1559         LA-10         0.0552         LE-10         0.0553         R-11           0.0210         LH-11         0.0532         V-10         0.1559         F-27-32         0.1559         LA-11         0.0054         LE-10         0.0553         R-11           0.0210         LH-13         0.0493         V-12         0.2456         F-27-32         LA-11         0.0014         LE-10         0.0529         LE-10         0.0529         LE-10         0.0529         LE-10         0.0529         LE-10         0.0529         LWF-1         0.0145         LR-12         0.0024         LE-12         0.0249         LR-12         0.0259         LWF-1         0.0145         LR-12         0.0249         LR-12         0.0259         LWF-1         0.0145         LWF-1	P.W	0.0522	9-H-T	0.0827	9-A	0.1654	F-21-22	0.1248	3. 4833	9-V7	0.0631	LE-6	0.1161	R-6	0.9826
0.0283         LH-8         0.0813         V-9         0.1742         F-25-30         0.1045         3.1640         LA-8         0.0726         LE-9         0.0544         R-8           0.0450         LH-9         0.0726         V-9         0.2496         F-26-31         0.0363         2.6415         IA-9         0.0029         LE-9         0.0544         R-8           0.0370         LH-11         0.0552         V-10         0.1559         I-11         0.0544         R-9         0.0549         I-11	LW-7	0.0051	LH-7	0.0936	V-7	0.1596	F-23-24	0.1379	3. 5254	LA-7	0.0058	LE-7	0.0856	R-7	0.9564
0.0450         LH-9         0.0456         LH-9         0.0456         LH-9         0.0450         LH-9         0.0450         LH-9         0.0459         LE-9         0.0459         R-10         0.0544         R-9         0.0459         V-10         0.1858         F-27-32         0.1559         1.8142         LA-10         0.0459         LE-10         0.0459         R-10         0.0552         V-10         0.1858         F-27-32         0.1559         LA-11         0.0454         LE-10         0.0459         V-12         0.2855         Position         V-10         0.0454         LE-11         0.0457         LE-11         0.0457         LE-12         0.0455         LWF-1         0.0455         LWF-2         0.0455         LWF-2         0.0455         LWF-3         0.0455 <td>I.W-8</td> <td>0.0283</td> <td>LH-8</td> <td>0.0813</td> <td>N-8</td> <td>0.1742</td> <td>F-25-30</td> <td>0.1045</td> <td>3.1640</td> <td>LA-8</td> <td>0.0726</td> <td>LE-8</td> <td>0.1045</td> <td>R-8</td> <td>0.9434</td>	I.W-8	0.0283	LH-8	0.0813	N-8	0.1742	F-25-30	0.1045	3.1640	LA-8	0.0726	LE-8	0.1045	R-8	0.9434
0.0203         LH-10         0.0552         V-10         0.1858         F-27-32         0.1559         T.8142         LA-10         0.0754         LE-10         0.0839         R-10           0.0210         LH-11         0.0552         V-11         0.3019         Wing Fan         LA-11         0.0014         LE-12         0.0247         R-11           0.0216         LH-13         0.0453         V-12         0.2853         LWF-2         0.0145         LE-12         0.0247         LE-12         0.0247         LE-12         0.0247         LE-12         0.027         LE-12         0.0247         LE-12         0.0253         LWF-3         0.0145         LWF-3         0.0145         LWF-3         0.0203         LWF-3         0.0145	LW-9	0.0450	LH-9	0.0726	6-7	0.2496	F-26-31	0.0363	2.6415	IA-9	0.0029	LE-9	0.0544	R-9	0.7141
0.0210         LH-11         0.0552         V-11         0.3019         Wing Fan         LA-12         0.0014         LE-11         0.0247         R-11           0.0377         LH-19         0.0493         V-12         0.2885         Position         + Up         LA-12         0.0827         LE-12         0.0283         R-12           0.0314         LH-12         0.0435         LWF-1         LWF-2         0.0145         LWF-1         0.0827         LWF-1         0.0827         LWF-1         0.0283         LWF-2         0.0145         LWF-3         0.0145	LW-10	0.0203	LH-10	0.0552	V-10	0.1858	F-27-32	0.1559	1.8142	LA-10	0.0784	LE-10	0.0639	R-10	0.7083
0.0377         LH-19         0.0493         V-12         0.2685         Position         + Up         LA-12         0.0827         LE-12         0.0283         R-12           0.0145         1.at. Defl. V-13         0.0435         LWF-1         - Up         - LWF-1         0.0435         LWF-2         0.0145         - LWF-1         0.0527         LWF-2         0.0145         LWF-2         0.0145         LWF-3         0.0203         LWF-3         0.0203         LWF-3         0.0145	LW-11	0.0210	LH-11	0.0552	V-11	0.3019		Wing	Fan	[A-11	0.0014	LE-11	0.0247	R-11	0.2758
0.0276         Lat. Defl. vol45         V-13         0.0435         Position + Up         + Up           0.0145         : Left vol45         V-14         0.0552         LWF-1         - Up           0.0290         LH-12         0.0687         V-16         0.0435         LWF-2         0.0145           0.0247         LH-20         0.0755         F-25         0.1045         LWF-4         0.0145           0.0174         + Aft ranger         F-26         0.0369         LWF-4         0.0145           0.018         LH-14         0.0083         F-27         0.1546           - LH-15         0.018         F-27         0.1546           - LH-16         0.0282         R-27         0.1546           - Aft ranger         LH-18         0.0348         R-27	LW-12	0.0377	LH-19	0.0493	V-12	0.2685			Vort Doll	LA-12	0.0827	LE-12	0.0283	R-12	0.2758
0.0145       : Left V 14       0.0552       LWF-1         0.0319       LH-12       0.0827 V 15       0.0435       LWF-2         0.0290       LH-13       0.0697 V 16       0.0268       LWF-2         0.0247       LH-20       0.0755 V 17       0.0203       LWF-2         0.0174       +Aft F-26       0.0369       LWF-3         0.0189       LH-14       0.083       F-27       0.1546         - LH-16       0.0215       - LH-16       0.0282         - Aft LH-18       0.0346       - LH-18       0.0346	LW-13	0.0276		Lat. Defl.	V-13	0.0435			dn +						
0.0319     LH-12     0.0827     V-15     0.0435     LWF-2       0.0290     LH-13     0.0697     V-16     0.0268     LWF-2       0.0247     LH-20     0.0755     V-17     0.0203     LWF-3       0.0174     F&A Deff     F-26     0.0369     LWF-4       0.0189     LH-14     0.0633     F-27     0.1546       0.016     LH-16     0.0215     P-27     0.1546       E&A Deff     LH-16     0.0282     P-27     0.1546       -     LH-16     0.0282     P-27     0.1546       -     LH-16     0.0282     P-27     0.1546	LW-14	0.0145		: Left	V-14	0.0552		LWF-1	-						
0.0247 LH-20 0.0755 V-16 0.0268 LWF-4 0.0247 LH-20 0.0755 V-17 0.0203 LWF-4 0.0174 +Aft F-26 0.0369 0.0116 LH-15 0.0148 - LH-16 0.0215 - LH-17 0.0282 +Aft LH-18 0.0348	LW-15	0.0319	LH-12	0.0827	V-15	0.0435		LWF-2	0.0145						
0.0247 LH-20 0.0755 V-17 0.0203 LWF-4 0.0247 F& A Deft.   F-26 0.0369   0.0116 LH-15 0.0148	FW-16	0.0580	LH-13	0.0697	V-16	0.0268		LWF-3	0 000						
0.0247	LW-17	0.0247	LH-20	0.0755	V-17	0.0203		LWF-4	00145						
0.0174 F-26 0.0189 LH-14 0.0083 F-27 0.0116 LH-15 0.0188 - LH-16 0.0215 - LH-17 0.0282 + Aft - LH-18 0.0348	LW-18	0.0247		F. 4 Poff	F-25	0.1045			20.0						
0.0189 LH-14 0.0083 F-27 0.0116 LH-15 0.0148 - LH-16 0.0215 - LH-17 0.0282 - Aft - LH-18 0.0348	LW-19	0.0174		100	F-26	0.0369									
0.0116 LH-15 - LH-16 - LH-17 - Aft LH-18	LW-20	0.0189	:	The state of the s	F-27	0.1546									
F& A Deft, LH-18	LW-21	0.0116	FH-14	0.0083											
F& A Deft, LH-18	LW-22	•	LH-15	0.0148											
F& A Deft, LH-18	LW-23	•	LH-16	0.0215											
- TH-18	1-	P.S. A Doff	LH-17	0.0282											
		+ Aft	LH-18	0.0348											
LW-25 - LW-26 - LW-27 -	LW-24	,													
LW-26 - LW-27 -	LW-25	•													
LW-27 -	LW-26	•													
	LW-27	1													

· Left Wing Down

TABLE 24

#### ANTISYMMETRIC MODE SHAPE MODE 11 f = 72.9 cps g = 0.025

	Wing	Hori	Horiz. Stab.	Vert.	Vert. Stab.	Fus	Fuselage (WL 100)	1001	Ail	Aileron	Ele	Elevator	Ruc	Rudder
	Vert. Defl.		Vert. Defl.		Lat. Defl.		Lat. Defl.	Lat. Defl. Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Defl.
Position		Position	•	Position	_	Position	+ Left	X103.	Position	+ Up	Position	+ Up	Position	+ Left
LW-1	'	LH-1	1.0000	V-1	-	F-11-12	•		LA-1	1	LE-1	0.6163	R-1	0.0163
LW-2	'	LH-2	0.3243	V-2	1	F-13-14		1	LA-2	,	LE-2	0.4084	R-2	0.0074
LW-3	•	LH-3	0.6082	V-3	,	F-15-16	1	1	LA-3	1	LE-3	0.8292	R-3	0.0129
LW-4	1	LH-4	0.4611	V-4		F-17-18		1	LA-4	1	LE-4	0.6287	R-4	0.0124
LW-5	1	LH-5	0.3126	V-5	1	F-19-20	,	1	LA-5	ı	LE-5	0.9530	R-5	0.0262
1.W-6	•	9-H7	0.5027	9-A	,	F-21-22	•	1	F-4-6	1	P-37	0.6510	R-6	0.0228
LW-7	1	LH-7	0.3490	V-7		F-23-24	•	1	LA-7	1	LE-7	0.7871	R-7	0.0282
LW-8	•	8-H7	0.1134	8-A	•	F-25-30	,	1	LA-8	•	LE-8	0.5248	R-8	0.0248
LW-9	•	LH-9	0.4488	6-A	1	F-26-31	,	•	LA-9	1	LE-9	0.4158	R-9	0.0228
LW-10	1	LH-10	0.1656	V-10	•	F-27-32	•		LA-10	•	LE-10	0.2030	R-10	0.0208
LW-11	1	LH-11	0.2995	V-11			Wing	Wing Fan	LA-11	1	LE-11	0.1485	R-11	0.0019
LW-12	1	LH-19	0.0104	V-12	•			Vert. Defl.	LA-12	1	LE-12	0.0545	R-12	0.0032
LW-13	,		Lat. Defl.	V-13	•		Position	+ Up						
LW-14	1		+ Left	V-14	•		LWF-1	-						
LW-15	1	LH-12	0.0396	V-15	'		LWF-2	1						
LW-16	,	LH-13	_		1		LWF-3	'						
LW-17	•	LH-20					LWF-4	1						
LW-18	,		1	_										
LW-19	1		+ Aft	_	,									
LW-20	,	LH-14		F-27										
LW-21	•	LH-15												
LW-22	,	LH-16	'											
LW-23	,	LH-17	'	_										
	F& A Defl.		•											
LW-24	•													
LW-25	1													
LW-26	1													
LW-27		_												

• Left Wing Down

TABLE 25

#### PRIMARY CONTROL SYSTEMS RESONANCES CTOL MODE

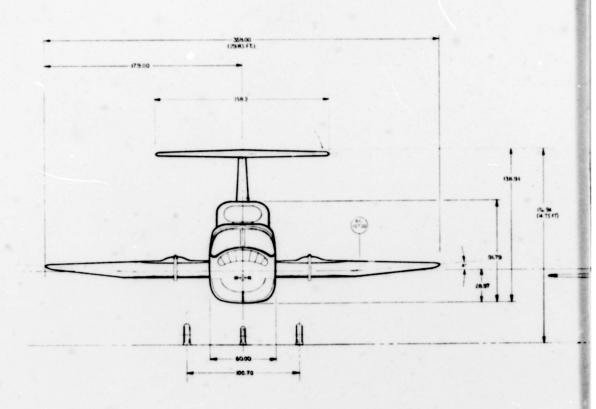
Component	Degrees of Freedom	Sense of Excitation	Location of Excitation	Frequency cps	Damping (g)	Remarks
Alleron System	Aileron Rotation Flight Tab Rotation Stick Rotation	Antisymmetric	Stick (A-CP)	48.6 92.3	_	
	Aileron Rotation	Antisymmetric	Aileron (LA-12) (RA-12)	42.1	_	
	Flight Tab Rotation			_		Inconclusive
	Aileron Rotation	Symmetric	Atleron (LA-12) (RA-12)	43.6	-	
	Flight Tab Rotation			79.1		
	Aileron Rotation	Antisymmetric	Aileron (LA-12) (RA-12)	42.9*	-	
	Alleron Rotation	Antisymmetric	Atleron (LA-12) (RA-12)	40.5*		Single Hydraulic Syster
	Aileron Rotation	Symmetric	Aileron (LA-12) (RA-12)	42.9*	_	
	Alleron Rotation	Symmetric	Aileron (LA-12) (RA-12)	40.2*	-	Single Hydraulic Syster
	Flight Tab Rotation	Antisymmetric	Tub (LAT-4) (RAT-4)	_	-	Inconclusive
	Flight Tab Rotation	Symmetric	Tab (LAT-4) (RAT-4)		-	Inconclusive
Elevator System	Horizontal Tail Rotation Elevator Rotation Stick Rotation	Symmetric	Stick (E-CP)	 18.3	-	Inconclusive
	Horizontal Tail Rotation	Symmetric	Elevator (LE-10 (RE-10	-	_	Inconclusive
	Elevator Rotation			24.4		
	Elevator Rotation	Antisymmetric	Elevator (LE-10 (RF-10			Inconclusive
Rudder System	Rudder Rotation Trim Tab Rotation Pedal Rotation	-	Pedal (R-CP)	17.0 —		Inconclusive
	Rudder Rotation Trim Tab Rotation	_	Rudder (R-9)			Inconclusive Inconclusive
	Rudder Rotation		Rudder (R-11)	7.3	_	
	Trim Tub Rotation	_	Tab (RT-3)	_		Inconclusive

<sup>\*</sup>Average of Left and Hight Ailcrons

TABLE 26

MISCELLANEOUS COMPONENT RESONANCES

		DOINT OF	FYCITATION	TAMOTHATION	O. C.
COMPONENT	POSITION	EXCITATION	FORCE POUNDS	FORCE POUNDS FREQUENCY cps	DAMPING (g)
Pitch Fan Doors	Forward Stick (43°)	NFD-2	10	17.9	. 203
Pitch Fan Doors	Neutral Stick (77°)	NFD-2	10	12.8	. 101
Pitch Fan Doors	Aft Stick $(92^\circ)$	NFD-2	10	13.9	. 270
laps	Streamwise (0°)	FL-2	S	56.3	High
laps	Fully Extended (45°)	FL-2	သ	42.7	. 082
Ving Fan Door	Fully Open (90°)	WFD-5	ည	19.4	High
fhrust Spoilers		Between TS-1 and TS-2	က	70.9	. 077





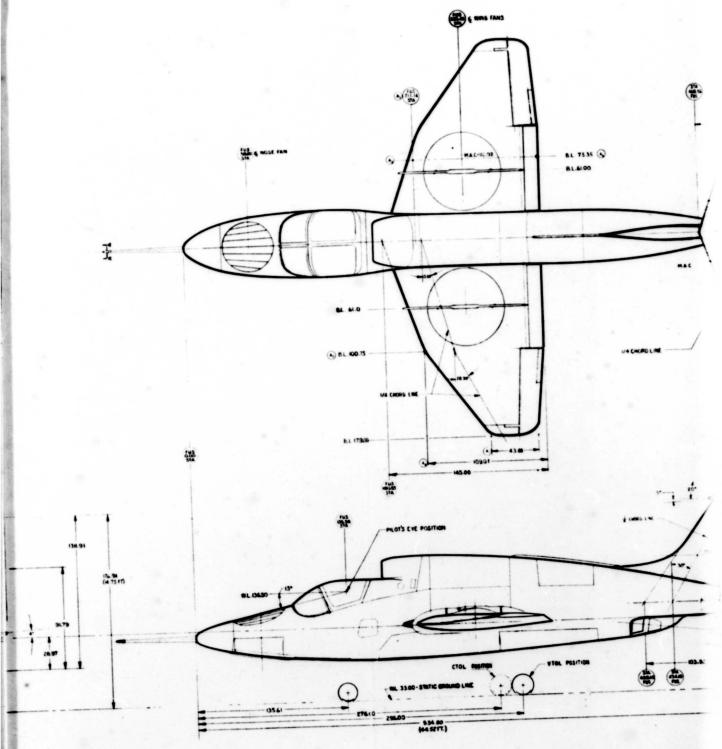


Figure 1 General Arra

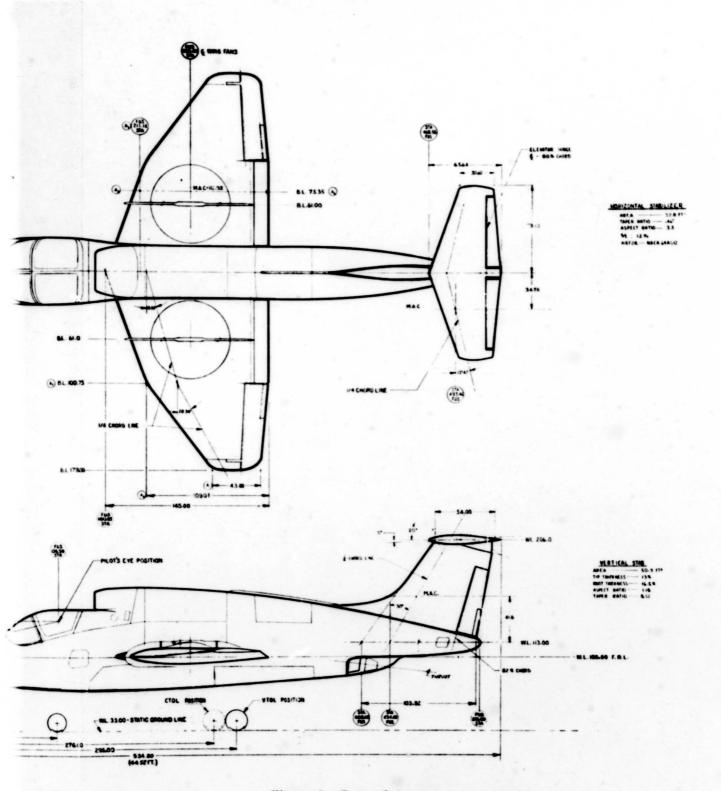


Figure 1 General Arrangement - XV-5A

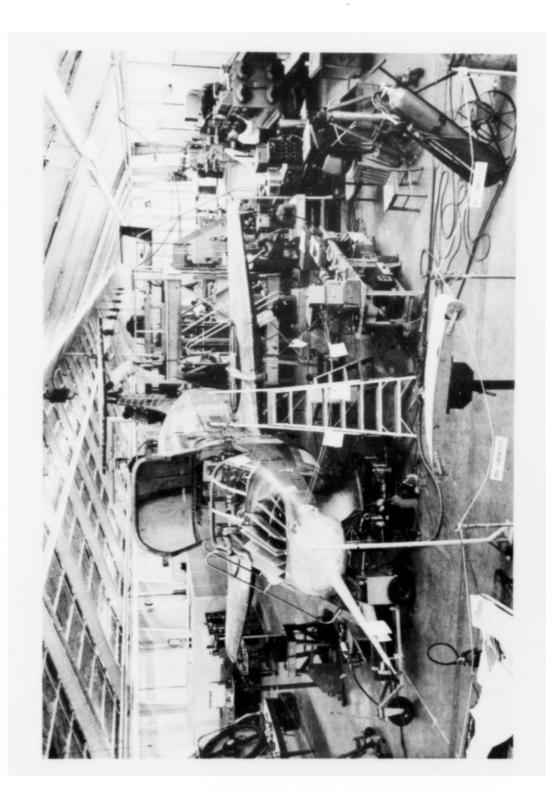


Figure 2 Airplane in Test Position Undergoing Final Test Preparation

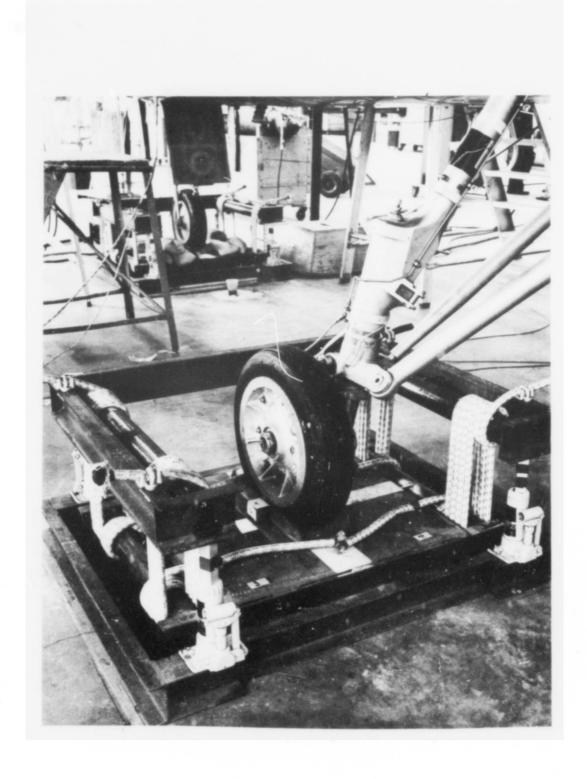


Figure 3 Details of Airplane Suspension System

#### ☐ PRIMARY

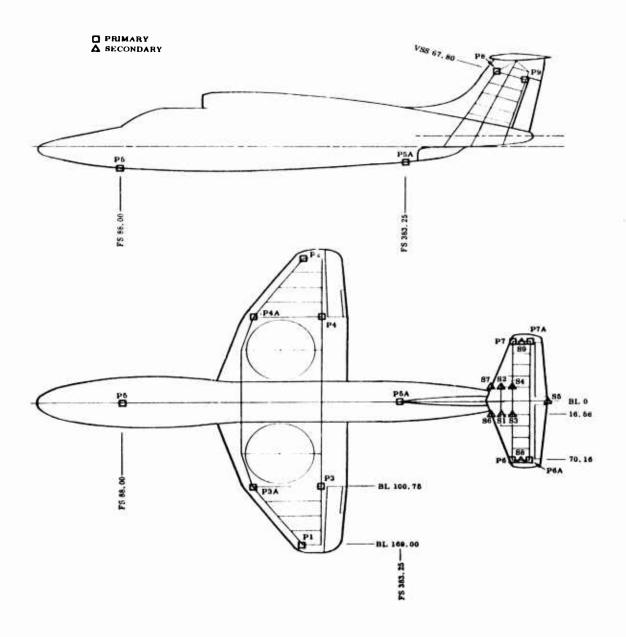


Figure 4. Shaker Locations

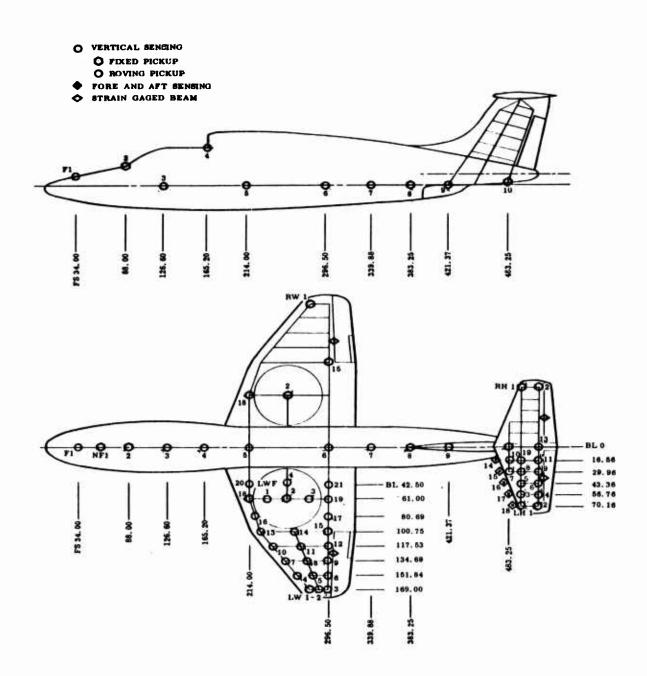


Figure 5. Symmetric Pickup Locations

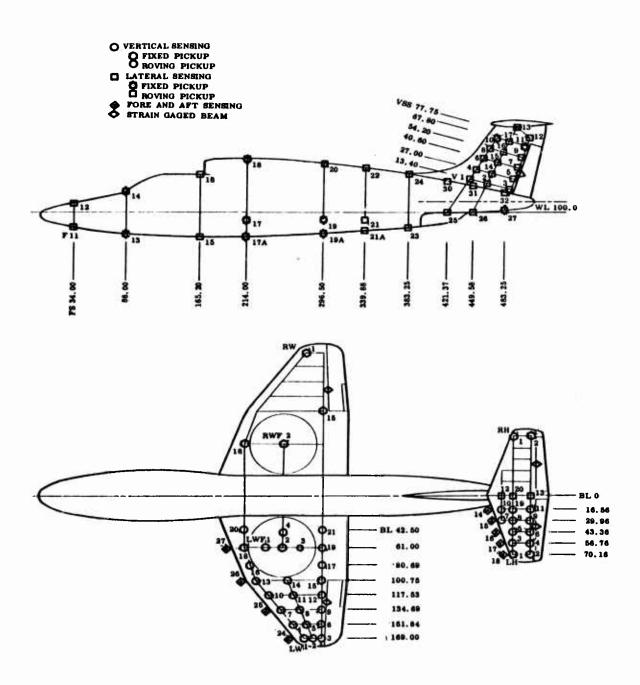


Figure 6 Antisymmetric Pickup Locations

Figure 7. Control Surface Pickup Locations - Aileron and Aileron Tab

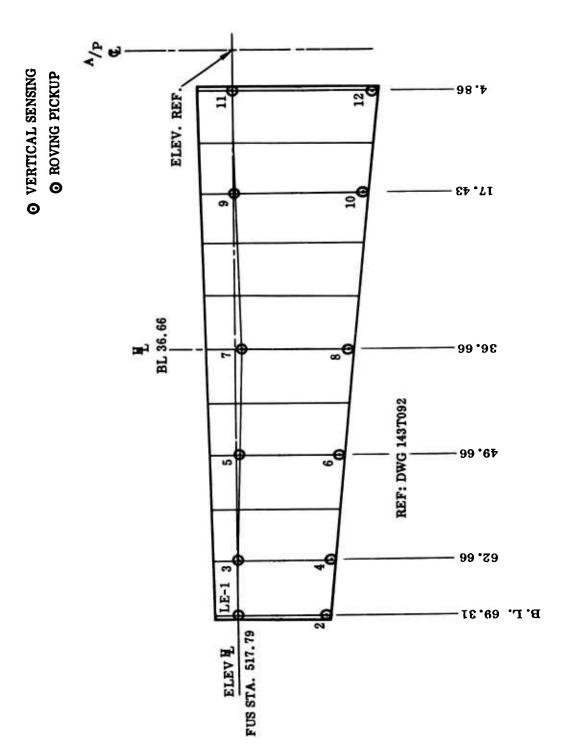


Figure 8. Control Surface Pickup Locations - Elevator

Figure 9 Control Surface Pickup Locations - Rudder and Rudder Tab

O LATERAL SENSING

O ROVING PICKUP

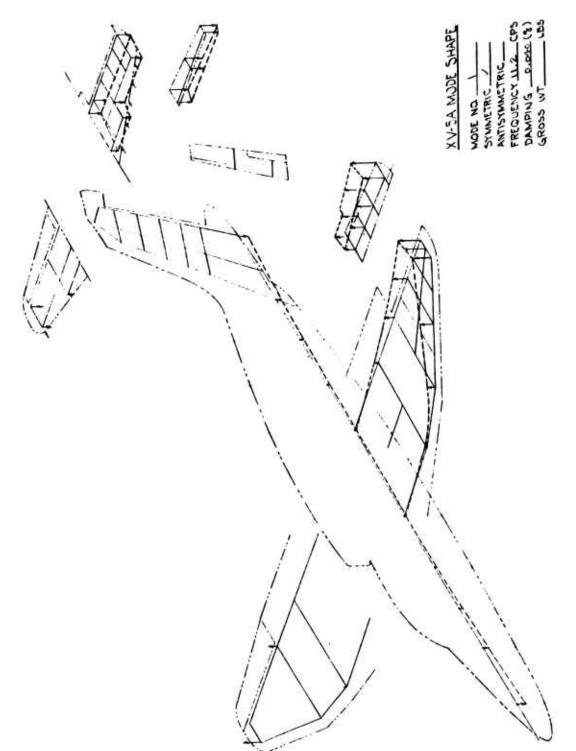


Figure 10 XV-5A Mode Shape - Mode No. 1

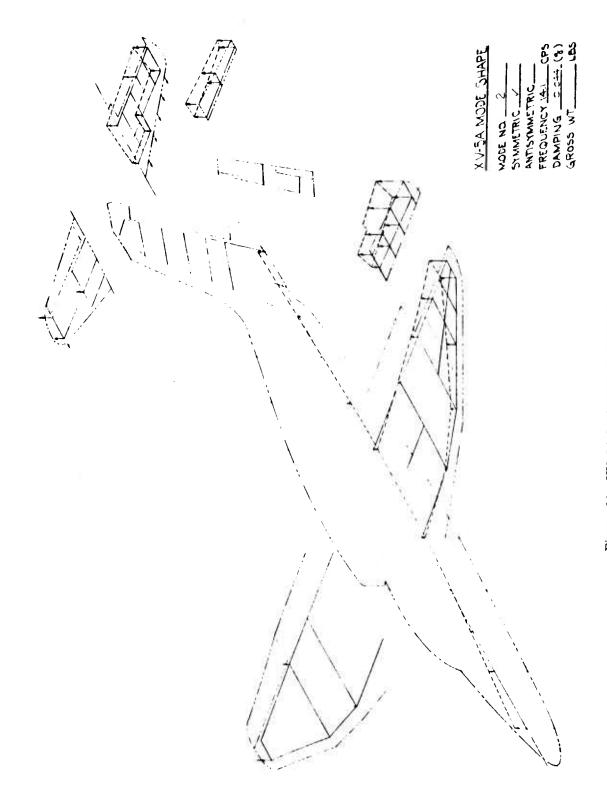


Figure 11 XV-5A Mode Shape - Mode No. 2

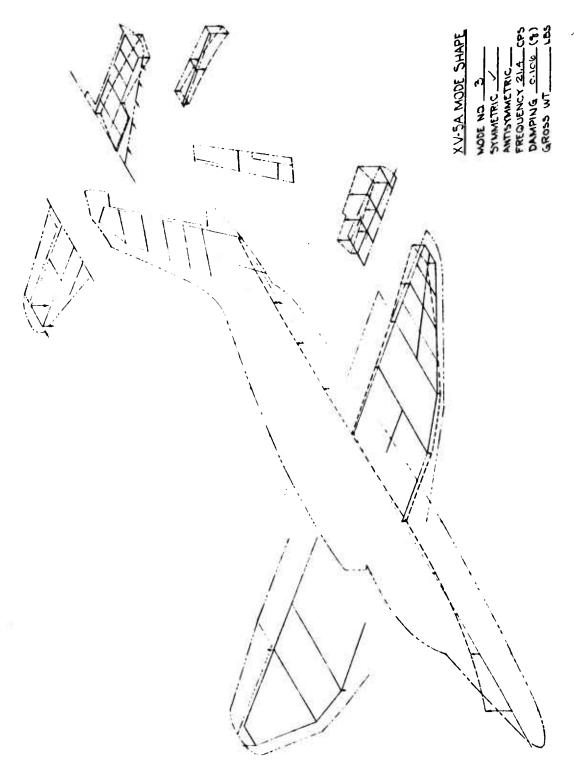


Figure 12 XV-5A Mode Shape - Mode No. 3

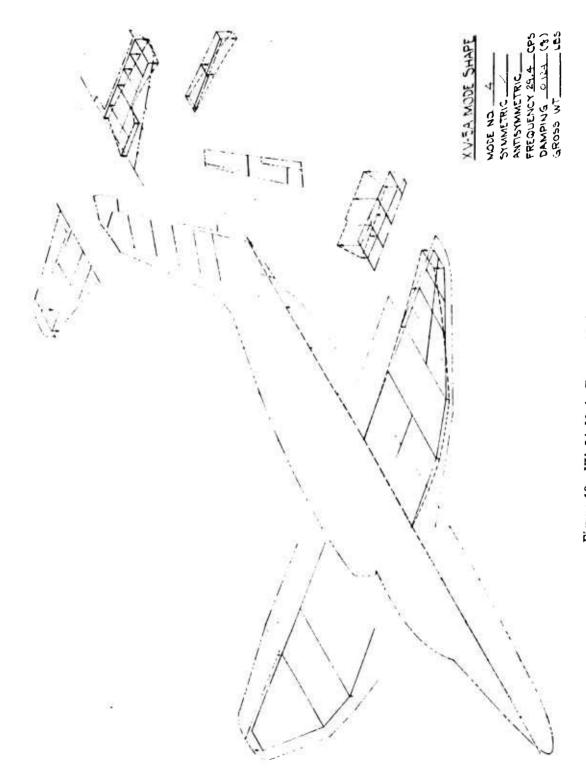


Figure 13 XV-5A Mode Shape - Mode No. 4

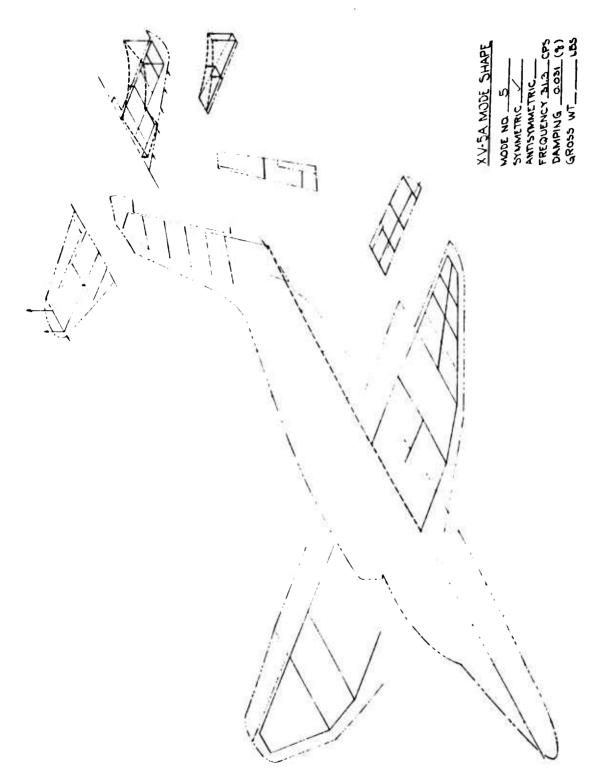


Figure 14 XV-5A Mode Shape - Mode No. 5

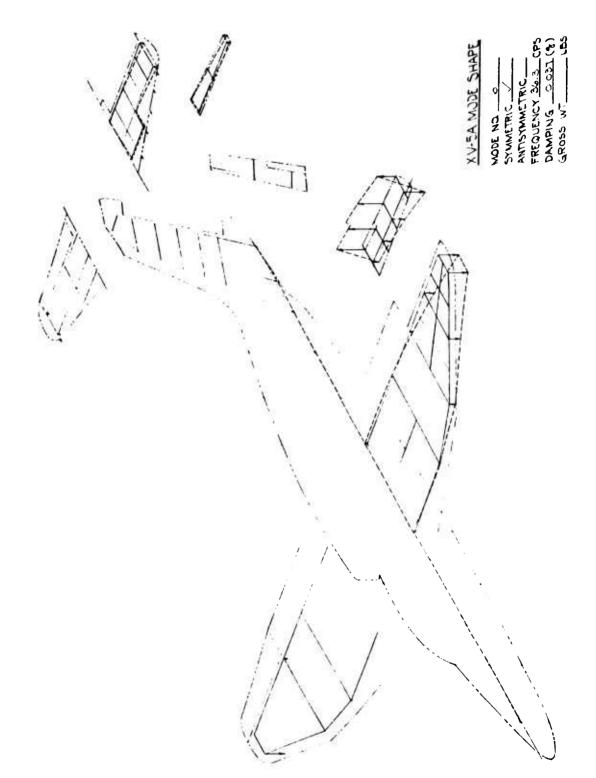


Figure 15 XV-5A Mode Shape - Mode No. 6

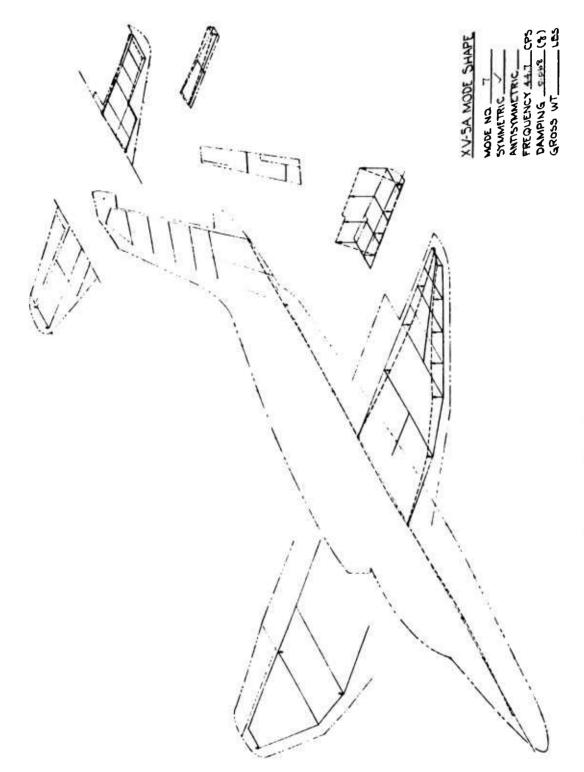


Figure 16 XV-5A Mode Shape - Mode No. 7

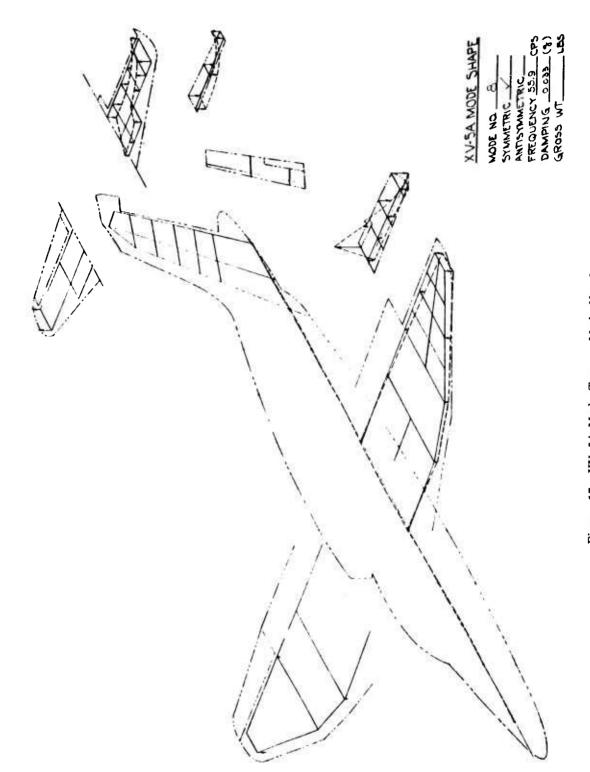


Figure 17 XV-5A Mode Shape - Mode No. 8

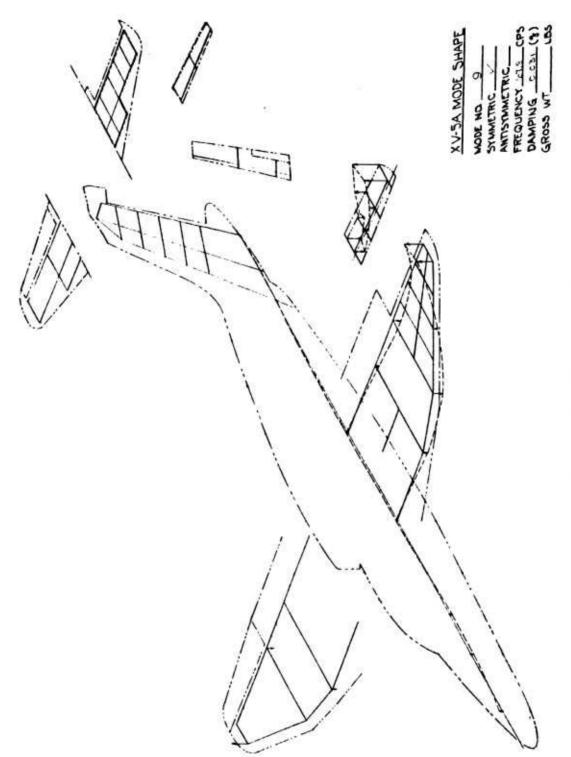


Figure 18 XV-5A Mode Shape - Mode No. 9

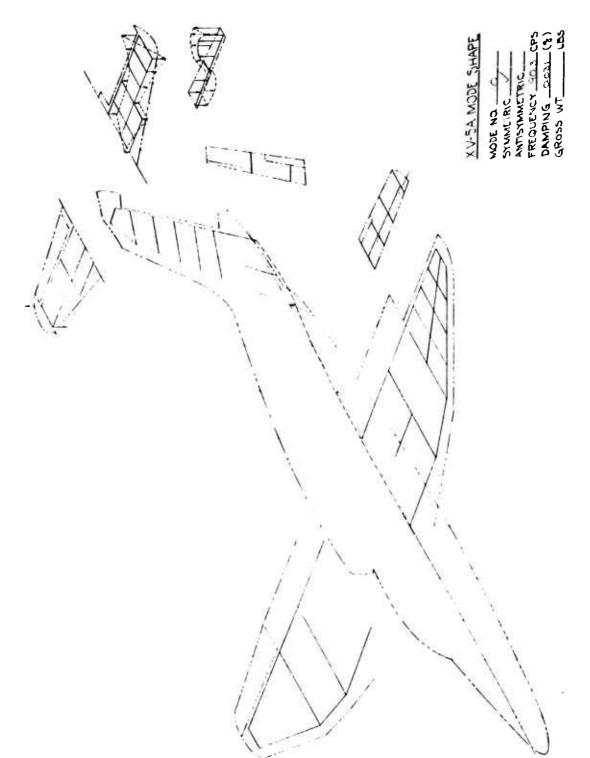


Figure 19 XV-5A Mode Shape - Mode No. 10

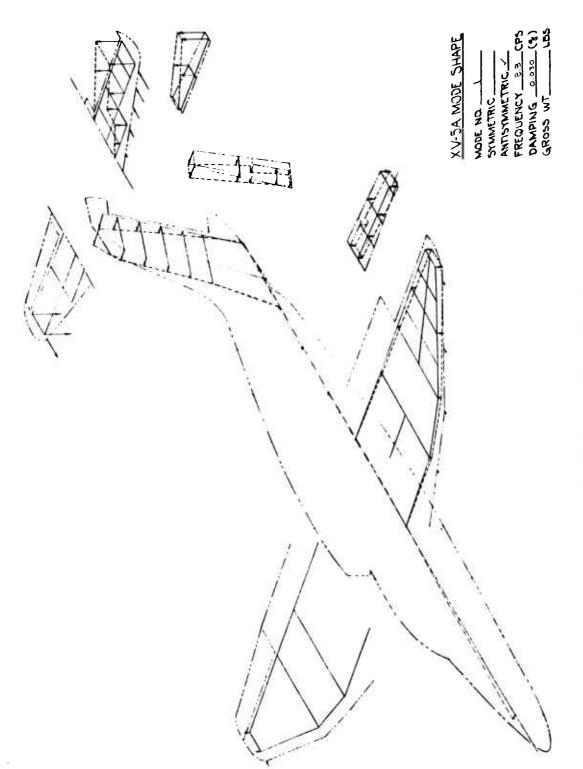


Figure 20 XV-5A Mode Shape - Mode No. 1

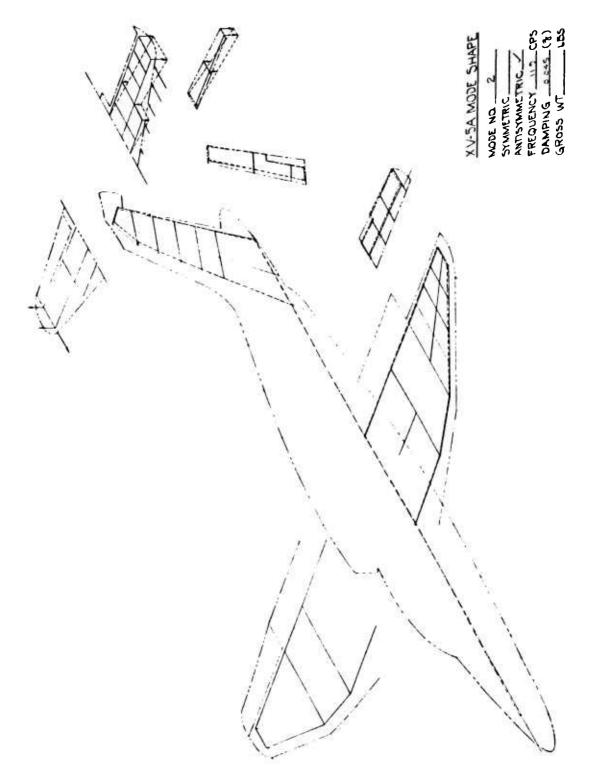


Figure 21 XV-5A Mode Shape - Mode No. 2

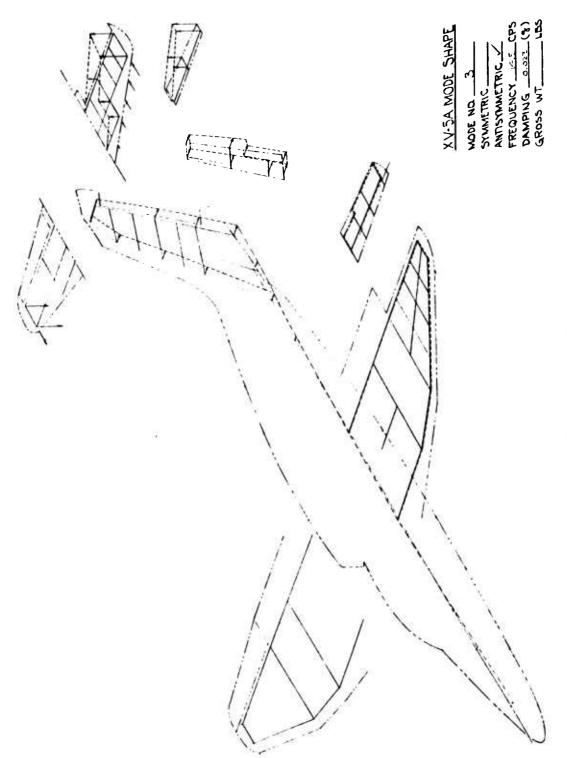


Figure 22 XV-5A Mode Shape - Mode No. 3

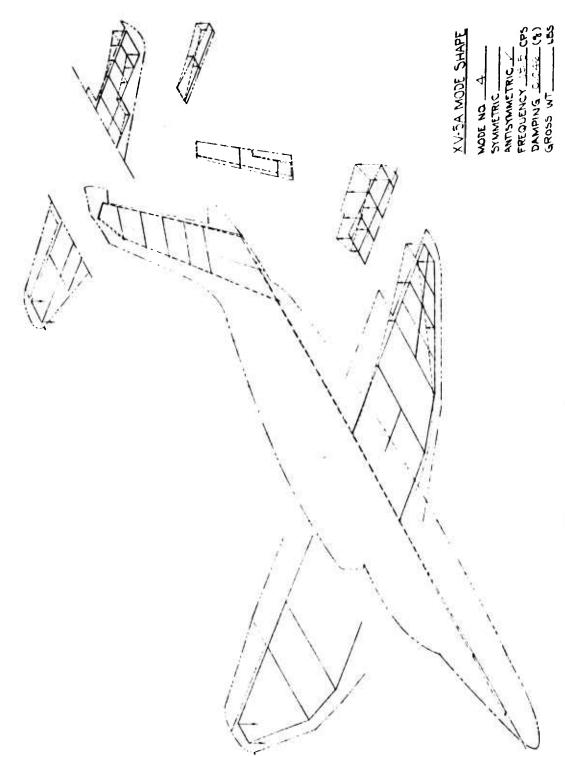


Figure 23 XV-5A Mode Shape - Mode No. 4

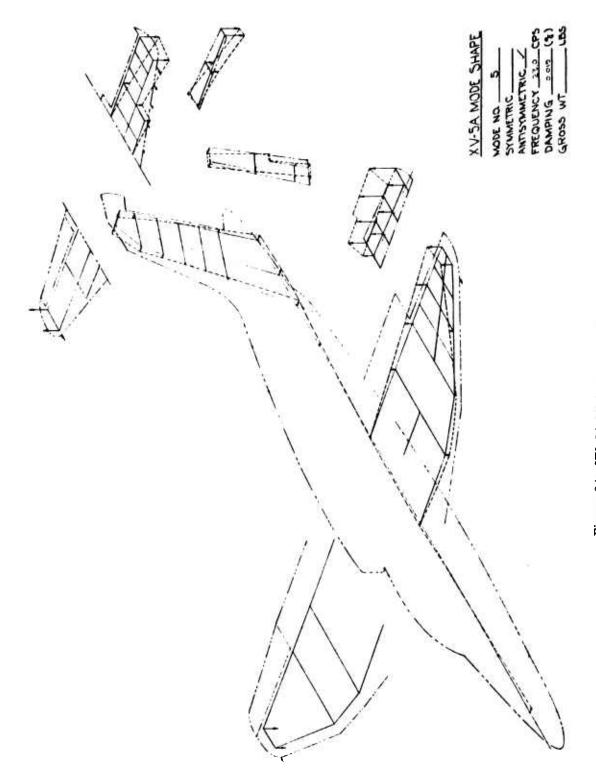


Figure 24 XV-5A Mode Shape - Mode No. 5

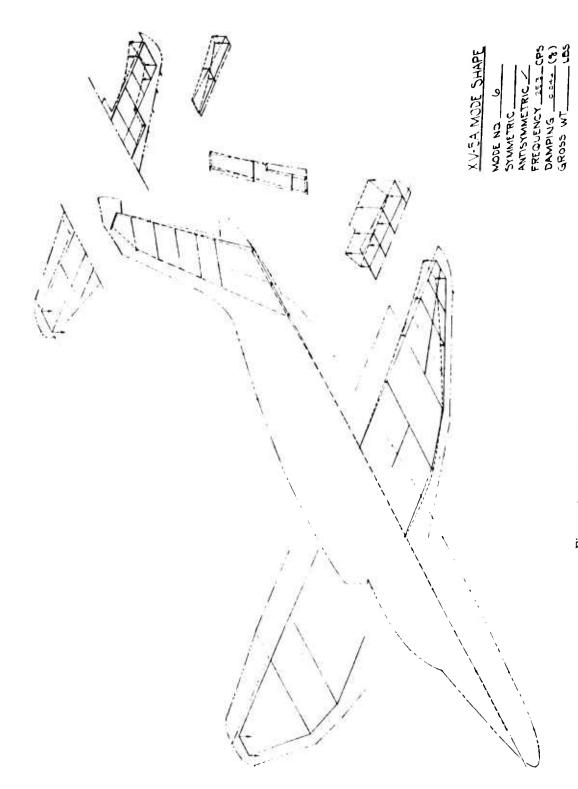


Figure 25 XV-5A Mode Shape - Mode No. 6

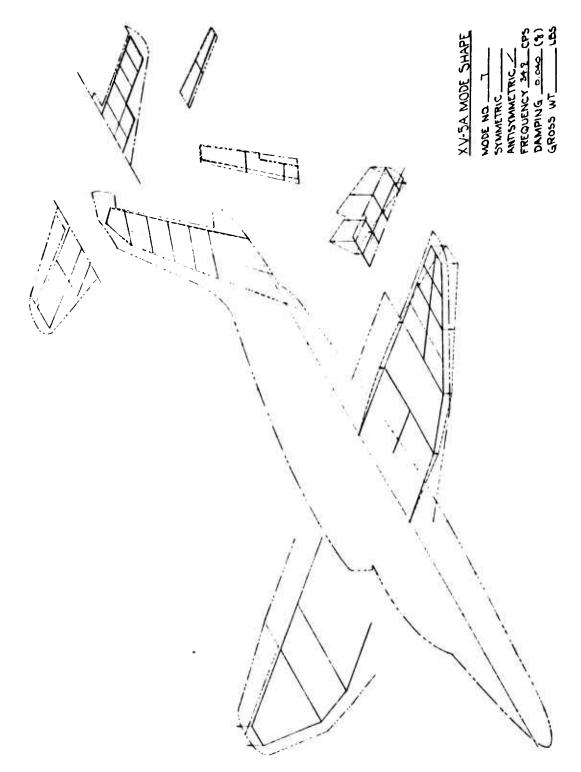


Figure 26 XV-5A Mode Shape - Mode No. 7

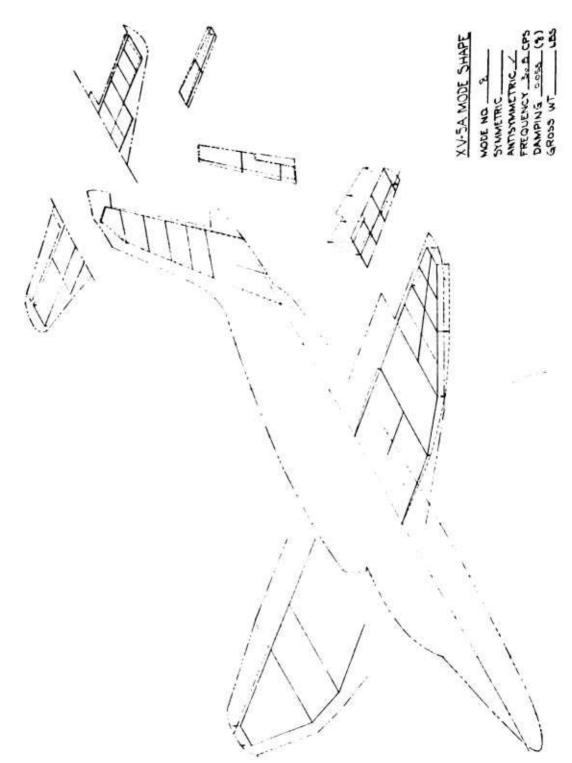
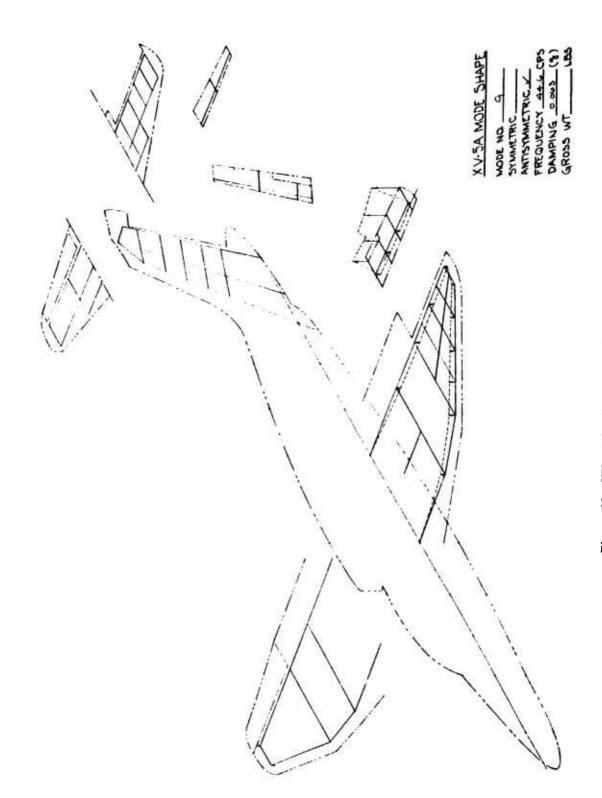


Figure 27 XV-5A Mode Shape - Mode No. 8



)

Figure 28 XV-5A Mode Shape - Mode No. 9

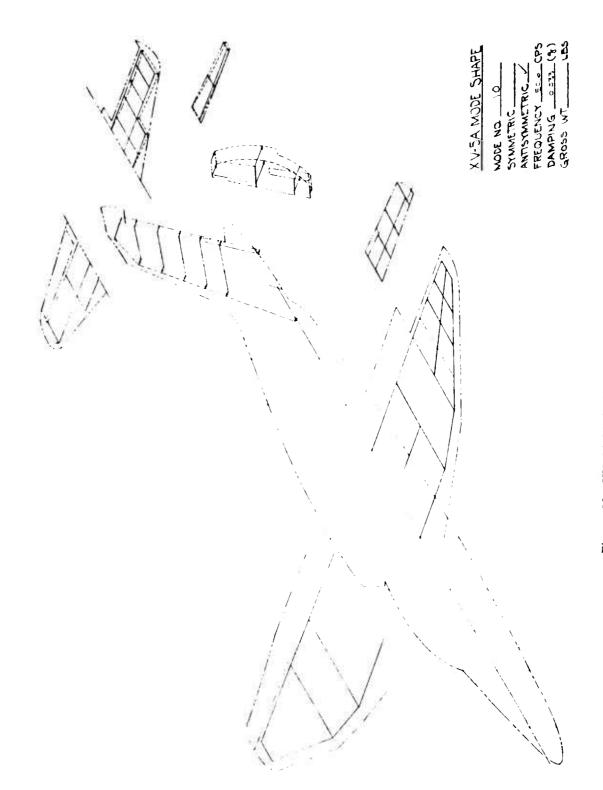


Figure 29 XV-5A Mode Shape - Mode No. 10

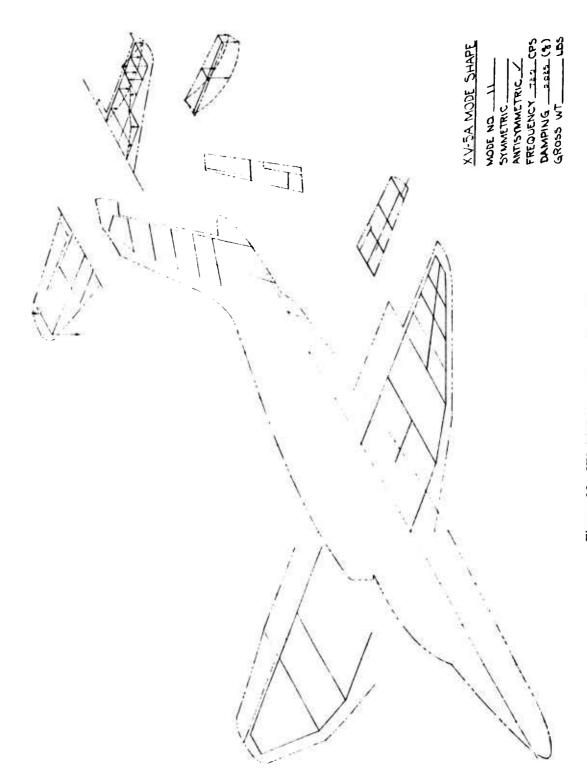


Figure 30 XV-5A Mode Shape - Mode No. 11

-STA 301.30 -STA 309.75 -STA 306.30 SURFACE REF. - STA 325,05 100.75 21.94 24.62 BL 92.58 92.58 100.58 REF: DWG 143W010 9 308.15 308.15 307.50 STA. INBD HINGE 3 ACTUATOR OUTBD " POINT

BL 99.70

Figure 31 Miscellaneous Component Pickup Locations - Flap

BL 24.75

BL 36.81

BL 50.936

BL 64.00

BL 81.00

BL 100.75

€ 6 T/E

BL 29.75

BL 43.174

BL 58.00

BL 72.50

BL 89.50

O ROVING PICKUP

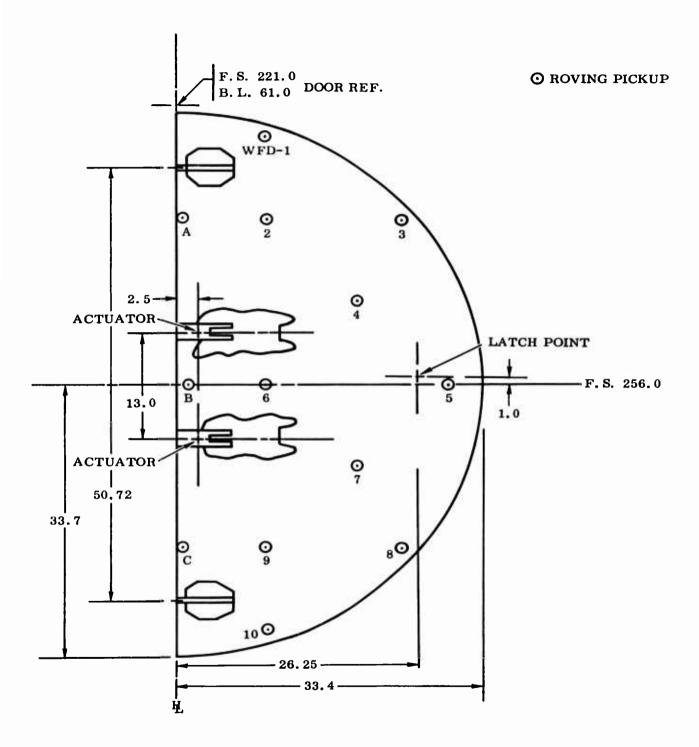


Figure 32 Miscellaneous Component Pickup Locations - Wing Fan Door

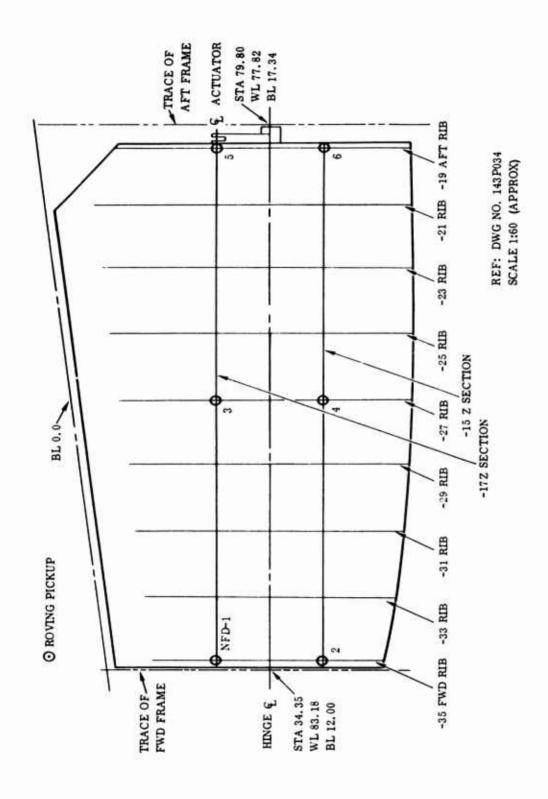


Figure 33 Miscellanous Component Pickup Locations - Nose Fan Door

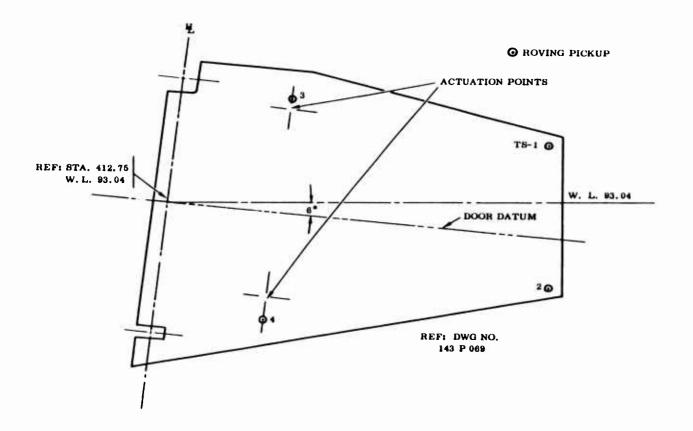


Figure 34 Miscellaneous Component Pickup Locations - Thrust Spoiler

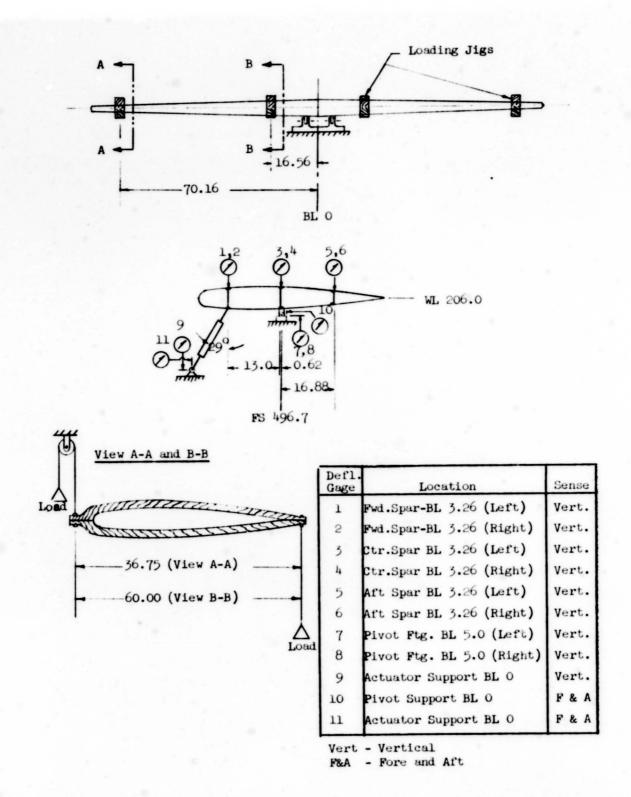
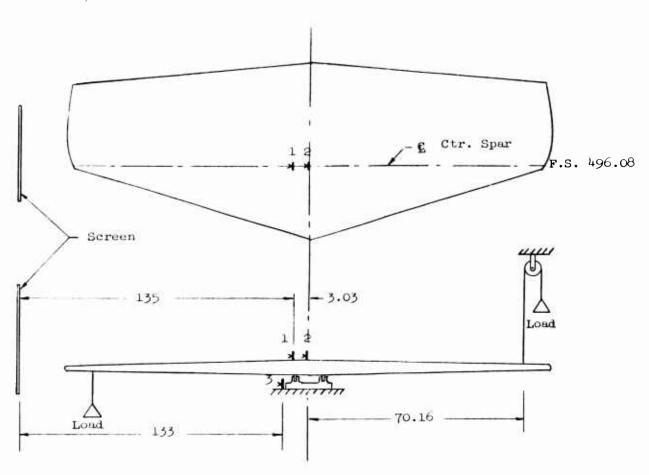
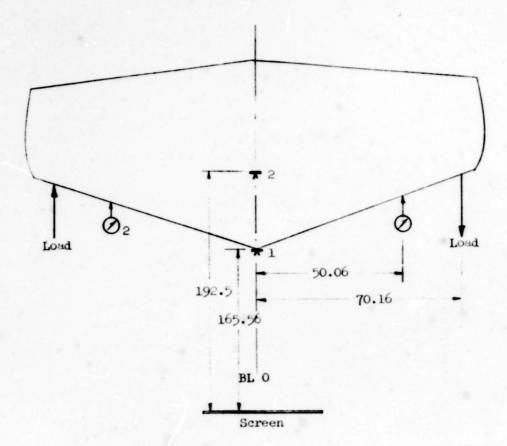


Figure 35. Horizontal Stabilizer Pitch Spring - Load and Instrumentation Schematic



Note: Load applied at Ctr. Spar > Indicates mirror position

Figure 36. Horizontal Stabilizer Roll Spring - Load and Instrumentation Schematic



Note: O Indicates Defl. Gage

\*\* Indicates Mirror Location

Mirror 2 Located on Support Jig
At Horiz. Stab. Pivot Fitting.

Figure 37. Horizontal Stabilizer Yaw Spring - Load and Instrumentation Schematic

Figure 38. Test Setup - Horizontal Stabilizer Pitch Restraint

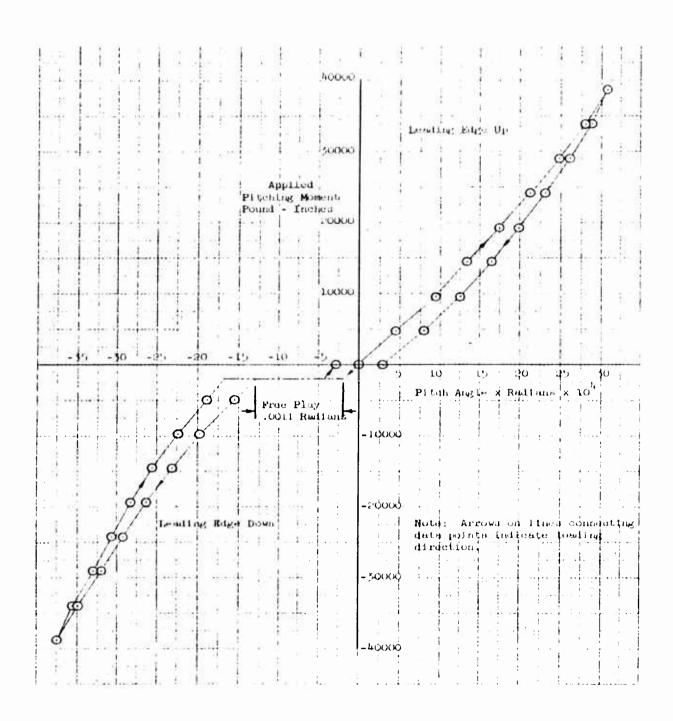


Figure 39. Horizontal Stabilizer - Pitch Free Play and Rotational Restraint

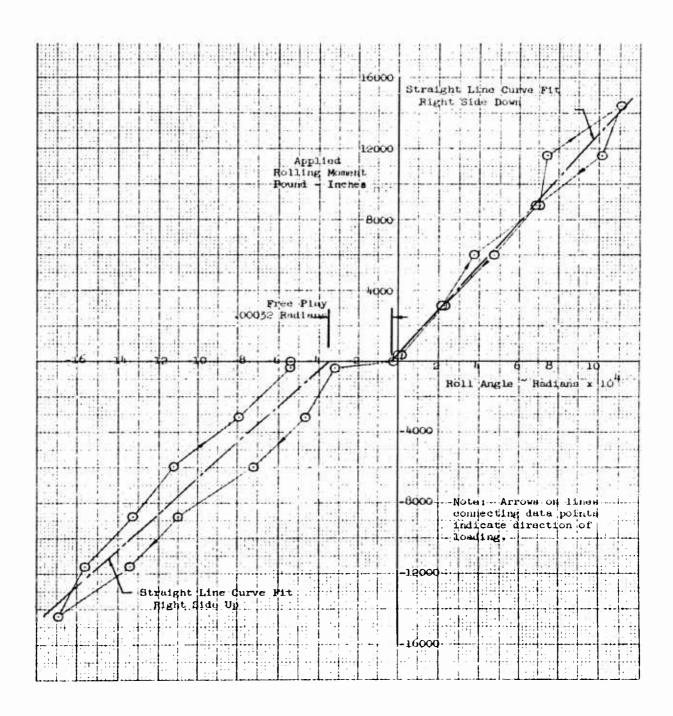


Figure 40. Horizontal Stabilizer - Roll Free Play and Rotational Restraint

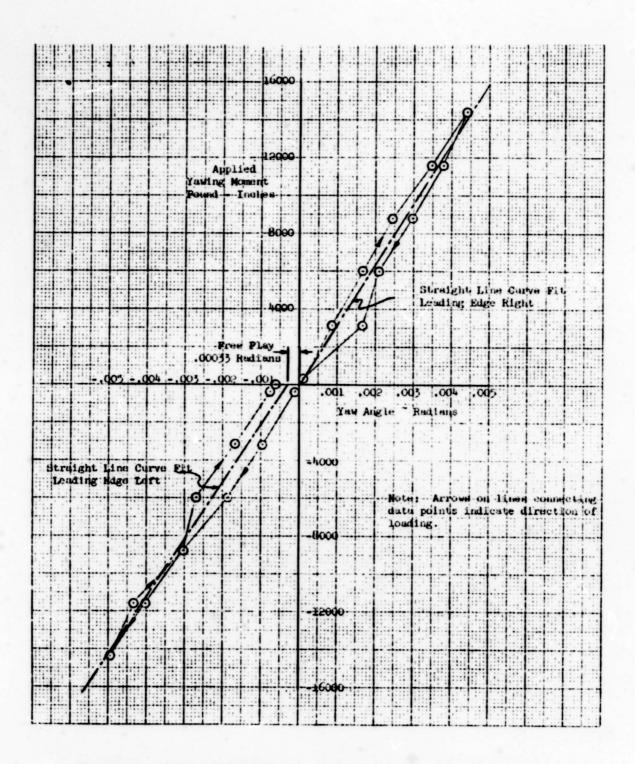


Figure 41. Horizontal Stabilizer - Yaw Free Play and Rotational Restraint

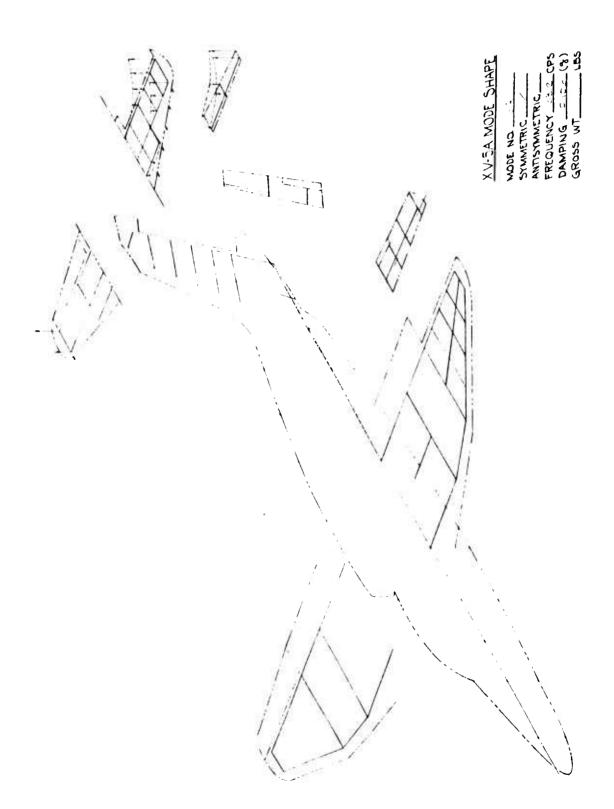


Figure 42 XV-5A Mode Shape - Mode No. 5A

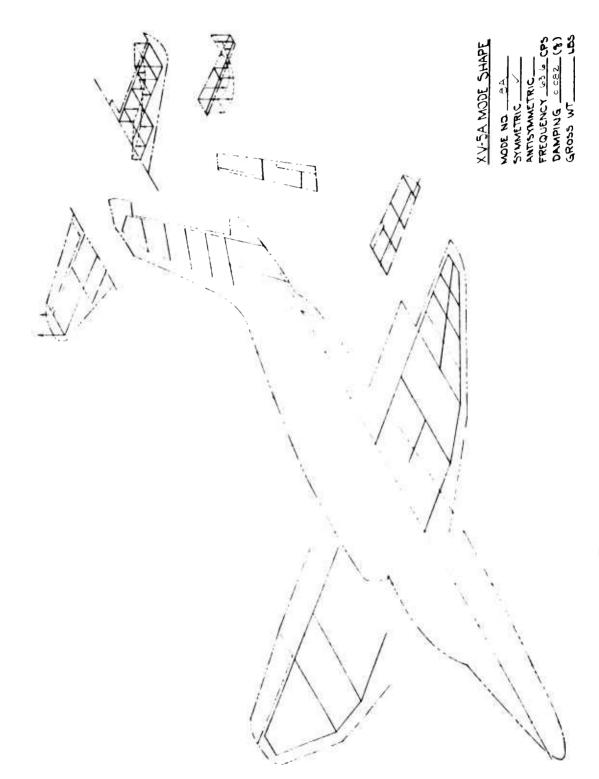


Figure 43 XV-5A Mode Shape - Mode No. 8A

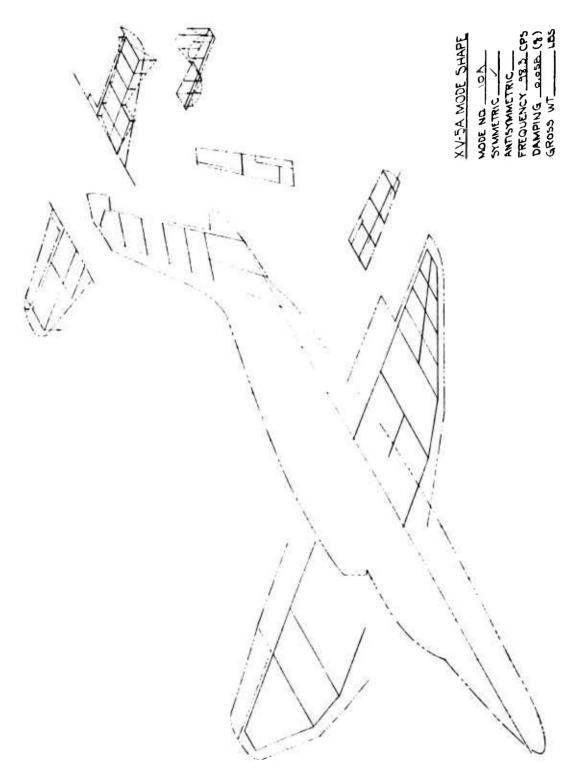


Figure 44 XV-5A Mode Shape - Mode No. 10A

Figure 45 XV-5A Mode Shape - Mode No. 11A

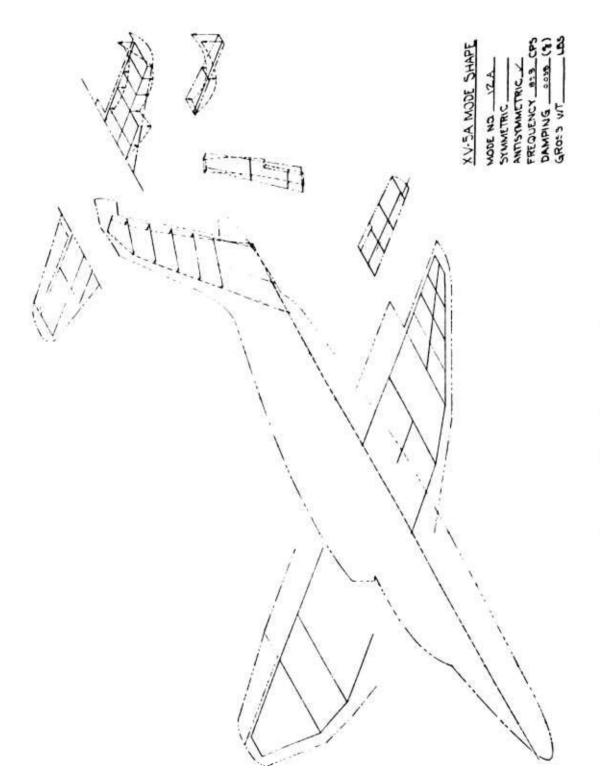


Figure 46 XV-5A Mode Shape - Mode No. 12A

### **BLANK PAGE**

### ADDENDUM A

### INTRODUCTION

Flutter considerations of the horizontal tail necessitated a reworking of the horizontal and vertical stabilizers to achieve a higher pitch frequency. Reference 3 presents the results of the preliminary flutter analysis of the empennage. These studies have shown that to meet the 15% flutter margin on the aircraft envelope, a uncoupled pitch frequency of approximately 55 cycles per second was required. The basic ground test of the airplane had shown this mode to be approximately 37 cycles per second, which was deduced from a combination of experimental and analytical results as discussed in Section 5.0. Accordingly, to check the results of the increased stiffness, a vibration test was conducted on the No. 1 aircraft (S/N 62-505) at EAFB during the period of 1 October, 1964 to 8 October, 1964. Emphasis was placed upon empennage characteristics with general checking of other modes in which doubtful areas existed.

### TEST CONFIGURATION AND INSTRUMENTATION

The aircraft configuration utilized for this test consisted of the complete aircraft (No. 1, S/N 62-4505), fueled for a gross wieght condition of approximately 9700 pounds with a c.g. location at F.S. 243.85. The aircraft was aligned in a level flight attitude simulating the CTOL mode, with all controls locked in neutral by means of the appropriate cockpit control. Wing and pitch fans were blocked to their stator blades by means of shock chord. To provide a soft mount the aircraft tires were reflated to 125 psig for the main gear and to 90 psig for the nose gear. The nose gear shock strut was filled with hydraulic fluid with locking bars intalled to eliminate the damping action of the strut.

Shaker equipment consisted of two (2) MB Model PT 112537 exciters with associated equipment. Recording instrumentation was similar to that used during the initial ground vibration test, except that one accelerometer (Endevco Model 2213) was used for modal surveys with one accelerometer used as a fixed reference.

### TEST PROCEDURE

In general, the test procedure followed that of the first ground vibration test. Initial frequency sweeps of the empennage were made utilizing the

two shakers at positions noted in Figure 4. Resonances were noted from the resulting response plots and modal surveys of the aircraft were made utilizing pickup locations as noted in Figures 5 through 9 upon establishment of the mode. Final oscillograph records were taken of the fixed instrumentation at the conclusion of the survey for frequency and damping values.

### RESULTS AND CONCLUSIONS

Excitation of the aircraft by hand produced the following rigid body aircraft modes:

Pitch	2.67 cps
Vertical Translation	$3.70   \mathrm{cps}$
Yaw	1.67 cps
Roll	$1.54~\mathrm{cps}$
Side Translation	1. 40 cps

From these results, it was concluded that aircraft suspension frequencies were adequate in view of the elastic modes determined from the first aircraft shake test.

Since stiffening of the horizontal tail pitch restraint is directly tied to symmetric vibration modes of the horizontal tail, initial emphasis was to find the equivalent modes as measured during the initial ground vibration test. The tail modes were numbered Modes 5, 8 and 10. (See Table 3) and were found to be primarily horizontal tail bending, horizontal tail pitch-torsion and a higher tail mode of primarily bending. The results of the second test showed the following in comparison to the original modes:

	1st T	EST	2nd '	FEST
	f	g	f	g
	eps		cps	
Mode 5	31.3	0.031	33.2	0.106
Mode 8	55.9	0.033	63.6	0.082
Mode 10	90.3	0.031	98.3	0.058

These modes are shown in Figures 14, 17 and 19 and are tabulated in Tables 8, 11 and 13 for the first test, whereas the results of the second test are shown in Tables 27, 28 and 29, with pictorial views shown in Figures 42, 43 and 44. Comparison of the modes show that although mode shapes are similar, frequencies have increased due to the stiffening. Neglecting differences between the two airplanes which might explain the

fifth mode frequencies, it was concluded that the second set of modes do actually represent the stiffening effect. As previously, a true uncoupled pitch mode was not readily determined. In order to determine the uncoupled pitch mode frequency, calculations were performed, on a modal coupling basis and correlated to the experimental results. These results indicate that an uncoupled pitch frequency of 47 cycles per second in turn coupled with a first bending mode (calculated) of 40.5 cycles per second and a first torsional mode (calculated) of 81.6 cycles per second, yielded as the first and second coupled frequencies 33+ and 63+ cycles per second respectively, which is in good agreement with the experimental results. The third coupled mode (calculated) yielded approximately 127+ cycles per second, whereas the third experimental proved to be 98.3 cycles per second. This was felt to be insignificant in that the flutter mode of concern was the pitch-torsion mode. The technique of modal coupling yields progressively poorer results for the higher modes.

The antisymmetric vibration test showed that the stiffening also played a part in changing the torsional characteristics of the horizontal stabilizer. The initial mode indicated a frequency of 72.9 cycles per second (shown in Figure 30 and Table 24) whereas the stiffening raised this to 80.3 cycles per second. The latter mode is tabulated in Table 30 and a pictorial view is shown in Figure 45.

Figure 46 depicts a higher antisymmetric bending mode of 89.8 cps per second with the mode shape tabulated in Table 31. This mode had been noted at approximately 77 cycles per second in the initial test, but had not been surveyed due to the relative unimportance of the mode.

Comparison of several modes taken during this second ground test with those obtained during the first ground test indicated no appreciable change due to suspension system restraints i.e. effects of spring-mounted platforms versus deflated gear. Difference in airplanes, that is in stiffness and/or weight were neglected in evaluating this effect.

TABLE 27

### SYMMETRIC MODE SHAPE MODE 5A f = 33.2 cps g = 0.106

				27.00	001.0 - 8 - 4-100				
A	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Deft.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	+ Up	Position	գր +	Position	+ Up	Position	+ Up	Position	dn +
LW-1	1	LH-1	0.6458	F-1	1	LA-1	1	LE-1	1.0000
LW-2	1	LH-2	0.9667	F-2	l	LA-2	l	LE-2	1.0000
LW-3	ı	LH-3	0.4167	F-3	ı	LA-3	ı	LE-3	0.8625
LW-4	1	LH-4	0.6667	F-4	ı	LA-4	1	LE-4	0.8542
LW-5	ı	CH-5	0.2083	F-5	1	LA-5	ı	LE-5	0.5917
FW-6	1	9-HT	0.4042	F-6	0.0092	LA-6	1	LE-6	0.5625
LW-7	I	LH-7	0.0521	F-7	0.0154	LA-7	ı	LE-7	0.3458
LW-8	1	LH-8	0.0250	F-8	0.0238	I.A-8	ı	LE-8	0.3167
LW-9	1	1.H-9	0.1792	F-9	0.0325	LA-9	ı	LE-9	0.1250
LW-10	1	LH-10	$\vec{0}.1250$	F-10	$\overline{0}$ .0658	LA-10	1	LE-10	0.1000
LW-11	I	LH-11	0.0417	Win	Wing Fan	LA-11	1	LE-11	0.0625
LW-12	ı	LH-12	0.1375		Vert. Defl.	LA-12	1	LE-12	0.0708
LW-13	1	LH-13	$\frac{0}{0}.0417$	Position	+ Up		_		
LW-14	1	LH-19	0.0583	LWF-1	1				
LW-15	l	LH-20	$\bar{0}$ . 1083	LWF-2	1				
LW-16	1		F & A Defl.	LWF-3	1				
LW-17	ł		' + Aft.	LWF-4	1				
LW-18	ı	LH-14	0.1925	Pitcl	Pitch Fan				
LW-19	!	LH-15	0.1925		Vert. Defl.				
LW-20	1	LH-16	0.1925	Position	4 Up				
LW-21	ı	LH-17	0.1925	NF-1	1				
LW-22	ı	LH-18	0.1925						
LW-23	 		_						

TABLE 28

## SYMMETRIC MODE SHAPE MODE 8A f = 63.6 cps g = 0.082

					100:0 0 cdo				
Δ .	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defil.		Vert. Defl.
Position	+ Up	Position	+ Up	Position	+ Up	Position	+ Up	Position	+ Up
LW-1	ı	LH-1	1.0000	F-1	0.0130	LA-1	-	LE-1	0.4300
LW-2	ı	LH-2	0.5200	F-2	0.0070	LA-2	ı	LE-2	0.7300
LW-3	ı	LH-3	0.6400	F-3	0.0000	LA-3	ı	LE-3	0.2000
LW-4	ı	LH-4	0.0700	F-4	$\tilde{0}.0050$	LA-4	ı	LE-4	0.4200
LW-5	ı	LH-5	0.3200	F-5	0.0080	LA-5	1	LE-5	$\bar{0}$ . 2000
9-MT	1	9-HT	$\bar{0}$ . 2800	F-6	0.0070	LA-6	ı	LE-6	$\vec{0}$ . 1400
LW-7	1	LH-7	0.4700	F-7	0.0050	LA-7	1	LE-7	$\bar{0}.5200$
LW-8	1	LH-8	0.1150	F-8	$\bar{0}.0240$	LA-8	ı	LE-8	$\bar{0}$ . 5700
LW-9	1	LH-9	0.4700	F-9	0.0350	LA-9	ı	LE-9	0.8000
LW-10	ı	LH-10	0.3500	F-10	0.0300	LA-10	1	LE-10	$\bar{0}$ . 8700
LW-11	1	LH-11	0.5500	Win	Wing Fan	LA-11	ŀ	LE-11	$\bar{0}$ . 7100
LW-12	1	LH-12	0.2300		Vert. Defi.	LA-12	ı	LE-12	$\bar{0}$ . 7300
LW-13	ı	LH-13	0.5700	Position	+ Up				
LW-14	ı	LH-19	0.0600	LWF-1	ı				
LW-15	1	LH-20	0.0530	LWF-2	ı				
LW-16	1		F & A Defl.	LWF-3	ı				
LW-17	1		+ Aft	LWF-4	ı				
LW-18	ı	LH-14	1	Pitc	Pitch Fan				
LW-19	ı	LH-15	l		Vert. Defl.				
LW-20	ı	LH-16	ı	Position	+ Up				
LW-21	ı	LH-17	1	NF-1	   				
LW-22	ı	LH-18	ı						
LW-23	i								

### TABLE 29

SYMMETRIC MODE SHAPE MODE 10A f = 98.3 cps g = 0.058

				1 = 98.3	I = 95.3 cps g = 0.058				
	Wing	Hori	Horiz. Stab.	Fus	Fuselage	Ail	Aileron	Ele	Elevator
	Vert. Defi.		Vert. Defl.		Vert. Defl.		Vert. Defl.		Vert. Defl.
Position	4 Up	Position	dn +	Position	+ Up	Position	t Up	Position	+ Up
LW-1	ı	LH-1	0.6613	F-1	1	LA-1	1	LE-1	0.3871
LW-2	1	LH-2	0.2645	F-2	1	LA-2	ı	LE-2	0.7903
LW-3	ı	LH-3	0.4452	F-3	ı	LA-3	ı	LE-3	0.6194
LW-4	ı	LH-4	0.0742	F-4	ı	LA-4	ı	LE-4	1.0000
LW-5	l	LH-5	0.2742	F-5	ı	LA-5	1	LE-5	0.5387
LW-6	l	1.H-6	0.0548	F-6	ı	I.A-6	ı	LE-6	0.7484
LW-7	1	LH-7	0.1935	F-7	1	LA-7	ı	LE-7	0.0000
LW-8	ı	LH-8	0.1387	F-8	ı	LA-8	l	LE-8	0.1000
LW-9	ı	LH-9	0.1161	F-9	ı	LA-9	!	LE-9	$\overline{0}$ . 4194
LW-10	١	LH-10	0.0645	F-10	ı	LA-10	ı	LE-10	$\bar{0}.6774$
LW-11	ı	LH-11	0.1548	Win	Wing Fan	LA-11	ı	LE-11	$\tilde{0}$ . 2613
LW-12	1	LH-12	0.0516		Vert. Defl.	LA-12	1	LE-12	$\bar{0}.5677$
LW-13	1	LH-13	0.1677	Position	4 Up	-	•		
LW-14	1	LH-19	0.0597	LWF-1					
LW-15	ı	LH-20	0.0226	LWF-2	ı				
LW-16	ı		F & A Defl.	LWF-3	ı				
LW-17	ı		+ Aft	LWF-4	1				
LW-18	ı	LH-14	1	Pitc	Pitch Fan				
LW-19	ı	LH-15	ı		Vert. Defl.				
LW-20	1	LH-16	ı	Position	+ Up				
LW-21	ı	LH-17	ı	NF-1					
LW-22	i	LH-18	ı	-					
LW-23	1								

TABLE 30

ANTISYMMETRIC MODE SHAPE MODE 11A f = 80.3 cps g = 0.091

•	Wing	Horiz.	. Stab.	Vert.	Vert. Stab.	Fuse	Fuselage (WL 100)	100)	Ail	Aileron	Ele	Elevator	Rud	Rudder
	Vert. Defi.		Vert. Defi.	-	Lat. Defl.	1	Lat. Defl. Ang. Defl.	Ang. Defl.		Vert. Defl.		Vert. Defl.		Lat. Dell.
Position	+ Up	Position	+ Up	Position	+ Left	Position	+ Left	X103.	Position	+ L'p	Position	t'p	Position	+ Left
LW-1	ı	LH-1	1.0000	V-1	1	F-11-12	,	1	LA-1	,	LE-1	0.4561	R-1	0.0161
LW-2	1	LH-2	0.2805	V-2	ı	F-13-14	ŀ	i	LA-2	ı	LE-2	$\bar{0}$ . 2341	<b>R-</b> 2	0.0132
LW-3	ı	LH-3	0. 5366	V-3	1	F-15-16	1	ı	LA-3	ı	LE-3	0.7634	R-3	0.0080
LW-4	ı	LH-4	0.4122	V-4	ı	F-17-18	1	ı	I.A-4	ł	LE-4	0.4634	R-4	0.0073
LW-5	1	LH-5	0.2317	V-5	ı	F-19-20	ı	ı	LA-5	ı	LE-5	0.8805		0.0176
မှ	ı	9-Н7	0.4634	9-1	ı	F-21-22	ı	ı	LA-6	ı	LE-6	0.5220	R-6	0.0161
LW-7	ì	LH-7	0.2707	V-7	•	F-23-24	ı	ı	LA-7	ı	LE-7	0.7122	, -Z	190
LW-8	ı	LH-8	0.0732	N-8	1	F-25-30	ı	ı	LA-8	ı	LE-8	0.3878	· œ	0.10.0
LW-9	1	LH-9	0.4163	6-A	ı	F-26-31	ı	ı	LA-9	ı	LE-9	0.3707	8-9	0.0176
LW-10	1	LH-10	0.1341	V-10	ł	F-27-32	ı	1	LA-10	ı	LE-10	0.1024	R-10	0.0168
LW-11	١	LH-11	0.2610	V-11	i	.1_	Wind Day	202	LA-11	1	LE-11	0.1317	R-1	8800
LW-12	1	LH-19	0.0220	V-12	i	.1	, III	r an	LA-12	ı	1 F-19	0.0780	12	90.0
LW-13	ı		Tat Defi	V-13	1		Docition	Vert. Dell.		_	- :		21-41	0.0038
LW-14	1		+ 10ft	V-14	,	-1	OSITION .	3						
LW-15		T.H-12	0 0329	V-15	ł		1-1W1	1						
LW-16		LH-13	0.0307	V-16	ı	-	7-147	1 1						
LW-17		LH-20	0.0095	V-17	ı		LUL	) (						
LW-18		i i	F & A Deft	F-25	ı	-		- I						
LW-19	ı		+ Aft	F-26	ı									
LW-20	ı	LH-14	,	F-27	1									
LW-21	ł	1.H-15	ı											
LW-22	1	1 1												
LW-23	ŀ	01-17	ı											
}	F. A. Doff	LH-17	-    -											
	+ Aft	LH-18	i											
LW-24														
LW-25	ı													
LW-26	ı													
I.W-27	1													
i		_												

TABLE 31

# ANTISYMMETRIC MODE SHAPE MODE 12A f = 89.8 cps g = 0.038

	wing	_	Horiz. Stab.	Vert.	Vert. Stab.	Fu	Fuselage (WL 100)	1000		Ailonon	1			
	Vert. Defl		Vert. Defl.		Lat. Defl.		Pol Dell	And Deft	6	icron	E	Elevator	Ruc	Rudder
Position	dJ.	Position	•	Position		Position	+ Left	+ Left X103*	Position	Vert. Defl.	Docition	Ve	-	1
LW-1		LH-1	0.1897	V-1	0.1126	F-11-12			:	1	LOSITION	1	Position	+ Left
LW-2	•	LH-2	0.6092	V-9	1101.0	101 4			1-6-1		LE-1	0.7299	R-1	0.2828
LW-3		LH-3	3008			11-01-1	,		LA-2		LE-2	1.0000	R-2	0 9356
I W.		:	0000		0.00.0	1-13-16		1	LA-3	,	1 5-2	0 5033		
	,	7.17	0.0087	1-1	0.1483	F-17-18	1	0 6114			, ,	0.0311	K-3	0.0816
LW-5		LH-5	0.4425	V-5	0.1322	F-19-20	0 0061			,	LE-4	0.8448	R-4	0.0414
P.W-6		LH-6	0.2126	V-6	1010	00 .00		1.3044	LA-5	,	LE-5	0.2184	R-5	0.0804
LW-7		. H.	011	. :	1011	F-77-72	0.0321	1.1903	F.A-6	,	LE-6	0.3563	9	000
			0.1.0	1-1	0.2046	F-23-24	0.0285	0.7961	LA-7	-		2000	0-4	0.0388
FW-9		LH-6	0.3678	V-8	0.1632	F-25-30	0.0099	1 1690			rr-i	0. 2609	R-7	0.1356
LW-9	1	LH-9	0.2931	V-9	0 9599	E 96 91		1.1003	24-6	,	LE-8	0.1839	R-8	0.1322
LW-10	•	LH-10	0 9713	01-10		10-02-1	0.0431	3.6842	E-8-	,	FE-9	0.4138	R-9	0 1264
LW-11	,	1 H-11	00000		0.1429	1-27-32	0.1117	8.4755	LA-10	,	LE-10	0.5517	B-10	1222
LW-12			0000	11-1	0.2471		Wing Fan	Fan	LA-11	ı	LE-11	0 1140		
		-1-UT	0. 2239	V-12	0.1897			Vor.	LA-12	,	1 5		11-11	0.0874
FW-13	1		Lat. Defl.	V-13	0.0115			reft. Dell.			FE-12	0. 2233	R-12	0.0110
LW-14	1		+ I.of	V-14	0.1425		Position	4. Cp						
LW-15	1	14.10	1000	V-15	1676		LWF-1	,						
LW-16	•		0.1504				LWF-2	1						
LW-17	•	LH-13	0.1322		60.1.00		LWF-3	'						
1 W-19			0.1552		0.1494		LWF-4	1						
	1		F & A Defl.		0.0092									
EW-19	ı		+ Aft	F-26	0.0483									
LW-20	1	I H-14	0 0057	F-27	0. 1057									
LW-21	,		0.000	-										
LW-22	1	CI-13	0.0115											
LW-99		LH-16	0.0161											
2		LH-17	0.0218											
	F & A Defl.	LH-18	0.0264											
	+ Aft													
LW-24	-													
LW-25	1													
LW-26	,													
LW-27	,													

\* Left Wing Down